

Virginia's 2015 Wildlife Action Plan

Prepared by the Virginia Department of Game and Inland Fisheries

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1. INTRODUCTION

BACKGROUND

In 1973, President Nixon signed the federal Endangered Species Act (ESA) into law, which declared that preventing species from becoming extinct would be a national priority. With funding provided by the U.S. Fish and Wildlife Service (USFWS), this legislation had a dramatic impact on wildlife conservation in North America. Now, in addition to programs managing game species, resources and personnel were also allocated to address the needs of nongame species. Over the next four decades, the conservation community achieved remarkable successes such as conserving the bald eagle, the American alligator, and the grizzly bear. While enjoying these successes, the conservation community also found itself at the center of intense disputes as efforts to conserve the northern spotted owl and to reintroduce the gray wolf to the northern Rocky Mountains divided communities and enflamed political rhetoric. Lastly, some species, such as the dusky seaside sparrow, became extinct despite of the protections the ESA provided.

Since the 1970's, state wildlife agencies have learned many important lessons. First, working to restore an endangered species can require decades of work and tens of millions of dollars. Second, by the time a species is declared to be endangered, populations have often declined to a point where conservation may not be possible. Third, once endangered, there are likely a limited number of individuals left and regulations put in place to protect the species may also reduce or prevent innovative approaches to restoration. Finally, an endangered species crisis, played out in the media, can require years of effort that do not address the underlying conservation problems in a proactive and collaborative manner. In the early 1990s, the Association of Fish and Wildlife Agencies (AFWA) described the federal ESA as an "emergency room" for species in crisis (Belanger and Kinnane 2002). Further, AFWA indicated this "emergency room" was often needed, but also expensive and stressful for both property owners and conservationists (Belanger and Kinnane 2002).

State agencies have collaborated with AFWA since the 1990s to develop proactive programs to help keep species from becoming endangered. As part of this effort, AFWA and the states worked with Congress, the White House, the USFWS, and thousands of stakeholders to develop a new funding mechanism to support this strategic conservation effort. In 2000, Congress created the State and Tribal Wildlife Grants (SWG) program to help state and tribal wildlife agencies work with at-risk species and prevent endangered species listings. This program currently provides funding to all 50 states, the five U.S. Territories, and the District of Columbia, making the SWG Program an invaluable conservation resource.

As a condition for receiving SWG funding, Congress mandated that each state and territory develop Wildlife Actions Plans (Action Plans) by October 2005. The Action Plans were conceived as an effort to guide states in identifying and addressing the needs of a wide array of wildlife and habitats of greatest conservation need. These Action Plans were also used to ensure the effective use of SWG funding. To guide development of these Plans, Congress established Eight Essential Elements that had to be addressed before an Action Plan could be approved by the Director of the USFWS (Public Law 106-291). These Eight Essential elements include:

- 1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife; and*
- 2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and*
- 3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and*
- 4. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions; and*
- 5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and*
- 6. Descriptions of procedures to review the Plan-Strategy at intervals not to exceed ten years; and*
- 7. Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Plan-Strategy with federal, state, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats; and*
- 8. Congress has affirmed through the Wildlife Conservation and Restoration Program and SWG that broad public participation is an essential element of developing and implementing these Plans-Strategies, the projects that are carried out while these Plans-Strategies are developed, and the Species in Greatest Need of Conservation (SGCN) that Congress has indicated such programs and projects are intended to emphasize.*

All states and territories submitted their Action Plans to the USFWS by October 1, 2005. Since being approved, these Action Plans have been a guiding force in wildlife conservation. Virginia's 2005 Wildlife Action Plan represented a strategy to conserve Virginia's wildlife resources. Although DGIF was the lead agency in developing the Action Plan, it was intended to be a strategy for statewide wildlife conservation and a framework for coordination and cooperation between agencies, academics, communities, and private conservation groups. DGIF and partners have used the Action Plan to identify key species and habitats in need of conservation and implement projects and research needed to address those issues on behalf of all Virginians.

Virginia's Action Plan is scheduled to be updated every 10 years. DGIF and partners view this update process as an important opportunity to reevaluate the status of species of greatest conservation need (SGCN) and their habitats, review conservation priorities, and reprioritize conservation actions. Furthermore, this update provides a process to review the conservation efforts, research, and projects implemented during the past decade. It also allows DGIF and partners to consider how the Action Plan and project prioritization might be improved to enhance efforts that keep species from becoming endangered. Based upon discussions with DGIF staff and conservation partners, Virginia's Action Plan

has been modified in several important ways. First, the updated Action Plan adopts a greater emphasis on habitat conservation. While single species efforts may be necessary to conserve the most critically imperiled species, scores of other species can be effectively and efficiently conserved via actions that protect and restore the quality of their habitats. Second, the new Action Plan also adopts the format used by the Virginia Outdoors Plan that communicates priority actions and needs at the local level (multi-county jurisdictions) (DCR 2013). By providing chapters for each of the 21 planning regions in Virginia, which are roughly analogous to Virginia's Planning District Commissions, it is hoped this new Action Plan will be better able to facilitate conservation actions among a diversity of conservation partners. The third major change focuses on enhancing species prioritizations. In addition to describing species' level of imperilment, the new prioritization scheme applies a triage approach to consider what actions can be taken to address threats to a species and its habitats. Finally, the Action Plan will be available in a more accessible format and develop a greater online presence. By enhancing its availability, it is hoped the Action Plan will be used by a greater diversity of land use and conservation partners throughout the Commonwealth.

2005 WILDLIFE ACTION PLAN IMPLEMENTATION

Over the last decade, Virginia's Wildlife Action Plan has become an important conservation resource and significant effort has been expended to address issues identified within its pages. Successful implementation of the Action Plan can be categorized into four main areas of work: species research, active resource management, land acquisition, and support and planning.

Species-specific research efforts have focused on helping Virginia's conservation community better understand the distribution, taxonomy, habitat requirements, and life history of a diverse set of SGCN. These data have been critical in helping biologists develop or improve species management efforts. State Wildlife Grant resources were used to develop a conservation strategy for the canebrake rattlesnake – a critically imperiled species impacted by habitat loss in south east Virginia. Joint research with the National Park Service resulted in a management agreement with Shenandoah National Park to manage the endangered Shenandoah salamander and may allow this amphibian to be removed from the federal list of endangered species. Finally, in a few cases, baseline surveys have identified previously unknown populations, indicating that species like the Dismal Swamp Southeastern Shrew, the southern bog lemming, the spotted margined madtom, the Teays River crayfish, and the stargazing minnow are more secure than previously thought and do not need to be included within Virginia's next Action Plan.

Other conservation management efforts have had a more direct and immediate benefit to SGCN and habitats within the state. Virginia was the first state to eradicate a population of non-native invasive zebra mussels that, if left unattended, could have devastated aquatic habitats and freshwater mussel populations. DGIF staff and partners implemented a predator control effort on Virginia's barrier islands that benefited dozens of beach nesting SGCN birds and the northern diamond-backed terrapin. Partnerships with municipalities and landowners focused on removing dams, improving water quality, and restoring riparian habitats along the James, Powell, and Rappahannock rivers. Finally, Virginia is a leader in the propagation of imperiled freshwater mollusks in the Tennessee River and the Atlantic slope watersheds.

Important lands were acquired to conserve SGCN and their habitats. The 750-acre Cavalier Wildlife Management Area (WMA) provides a variety of forested and open habitats utilized by SGCN as diverse as canebrake rattlesnakes and neotropical migrant songbirds. The Cavalier WMA also provides Virginia's

best opportunity for restoring a stand of Atlantic white cedar, a once common but now rare forest type, known to support several SGCN. The 2,500 acre Mattaponi WMA was purchased in cooperation with Fort AP Hill and other partners and provides a diversity of aquatic and terrestrial habitats that support almost 60 SGCN species. While these efforts are expensive, they represent a permanent conservation achievement.

The last category of activities involves a range of support and planning services. The original Action Plan frequently described how devastating the loss or degradation of habitats can be to species. Often these impacts are caused by human activities. DGIF's Environmental Services Section has incorporated the Wildlife Action Plan into their review and commenting process for construction or development projects. Likewise, the Virginia Fish and Wildlife Information Service, Virginia's comprehensive wildlife database, has embraced the Action Plan and works to provide a variety of distribution, habitat, and conservation information about the SGCN. Finally, climate change was identified as a significant threat to several Action Plan species. Since, 2008, Virginia has been a leader in working to develop strategies that address climate change within the updated Action Plan.

Undoubtedly, the original Action Plan has helped Virginia conserve SGCN. However, in discussions with DGIF staff, partners, and members of the public, a variety of concerns were identified as impediments to its full implementation. The updated Action Plan will address the identified weaknesses while allowing the conservation community the opportunity to evaluate this conservation tool and adapt efforts to meet new needs and challenges.

GOALS FOR THE UPDATED WILDLIFE ACTION PLAN

The primary purpose of this updated Action Plan is to identify conservation actions that will benefit a diversity of species and habitats and describe where those conservation actions should be implemented. Based on the extensive work to implement the first Action Plan, several key lessons and concerns emerged to inform the update process. First, the original Wildlife Action Plan was organized by ecoregions. Each ecoregion chapter included background information on the ecoregion and more specific details for a selection of SGCN found within the ecoregion (e.g., species life history, habitat description and status, threats, conservation actions, and research and monitoring needs). The ecoregion sections were informative and included relevant information for some species. Unfortunately, none of Virginia's conservation partners manage resources based upon ecoregion boundaries, making the 2005 Action Plan less "actionable" than was desired.

A second concern involved the prioritization of projects implemented from the Action Plan and how those efforts related to conservation partners. Much of the implementation has focused on single species survey and research efforts. The majority of these efforts focused on species that were already critically imperiled and this prioritization prevented many DGIF divisions and staff from aligning closely with the Action Plan. Likewise, partners that were not specifically focused on threatened and endangered species were less able to identify actions applicable to their work.

Finally, there were concerns over the depth and efficacy of the conservation goals that were identified in the original Action Plan. DGIF recognizes the importance of developing a more robust set of priorities. With the first Action Plan important and necessary actions were outlined but without any specific prioritization. While this strategy provided great management flexibility, it also resulted in a degree of confusion as to which actions should be addressed first.

Based upon these lessons, the five primary goals for the next Action Plan include:

- *Using a habitat approach to address threats and conservation issues* – The revised Action Plan focuses conservation efforts at the habitat level in order to address threats and conservation issues for a broader array of SGCN.
- *Being relevant at a more local geographic scale* – The updated Action Plan is written to provide resource managers with information about priority species, habitats, threats, and conservation actions in their area of focus and influence.
- *Prioritizing species and actions* – The updated version of the Action Plan places a focus on prioritizing both SGCN and conservation actions at a local level. In this way, conservation within Virginia can be carried out in areas in the most need of action or areas where efforts are most likely be successful/ beneficial.
- *Representing an array of partners* – The contents of this Action Plan focus on SGCN and habitats that are managed by a diversity of federal, state, and local agencies as well as private organizations and individuals that implement conservation efforts throughout Virginia. Whenever possible, relevant tools and priorities developed by these partners have been incorporated into the Action Plan.
- *Emphasizing effectiveness* – The Action Plan includes specific procedures that will allow DGIF and others to measure the effectiveness of conservation actions implemented from the Action Plan.

VALUE OF AN UPDATED ACTION PLAN

Virginia has a vast array of biodiversity and habitats from the coast to the mountains. Natural resource conservation in Virginia, as in most states, is tackled by government agencies, non-governmental organizations, private institutions, and public citizens. This conservation community collaborates across the Commonwealth to maximize the opportunities for conserving wildlife and habitats. Virginia's Action Plan provides a statewide and local blueprint for conservation actions needed to keep species from becoming endangered. Information regarding these resources is provided at multiple levels, ranging from single species needs to habitats and watersheds. The Action Plan is designed to help all conservation actors understand species and habitats priorities at a state and local levels and the types of actions needed within their area of responsibility or even backyard. The Action Plan includes 884 SGCN; it covers over 13 habitat types; and it is divided into 21 individual Local Action Plan Summaries that include priority SGCN and threats and conservation actions by habitat.

The process of updating this Action Plan allowed federal, state, and local agencies as well as nonprofit organizations, academic institutions, and other entities to identify common goals and actions that will help all players work more efficiently at achieving conservation success. This Action Plan is meant to build upon existing partnerships, enhance and prioritize programs, build support for the identified priorities, and lay the foundation for effectively and efficiently implementing conservation actions throughout the Commonwealth.

UPDATED PLAN STRUCTURE

The updated Action Plan has two main sections – the introductory and statewide materials followed by a series of multi-county Local Action Plan Summaries, with the latter forming the bulk of the document. This format is a significant departure from Virginia’s first Action Plan’s structure. After vetting this new model with DGIF staff and administrators, staff from state and federal agencies, partner organizations, and a handful of municipalities, this new structure was created to better facilitate the implementation of conservation actions. The Eight Essential Elements required of every Wildlife Action Plan are addressed within various sections as indicated below:

- *Introduction* provides background information and an overview of the Wildlife Action Plan.
 - Purpose of Wildlife Action Plan
 - Implementation of 2005 Action Plan
 - 2015 Wildlife Action Plan Goals
 - Wildlife Action Plan Value
 - Plan Structure
- *Methods and Approach* (Elements 5, 6, 7, and 8)
 - Overall approach to updating the Action Plan
 - Revision of the SGCN List
 - Habitat Approach
 - Local Action Plan Summaries
 - Prioritization of Conservation Actions and Focus Areas
 - Stakeholder and Public Input (Element 7 and Element 8)
 - Plan Revision (Element 6)
 - Monitoring (Element 5)
 - Effectiveness measures (Element 5)
- *Statewide Threats, Actions, and Priorities* (Elements 1, 2, 3, 4)
 - Summary information on the SGCN (Element 1)
 - Habitat descriptions and status (Element 2)
 - Statewide threats to species and habitats, including climate change (Element 3)
 - Statewide conservation actions (Element 4)
 - Research needs (Element 3)
- *Local Action Plan Summaries* (Elements 1-5)
 - Overview of planning region
 - Priority SGCN and habitats in the planning region
 - Planning region threats by habitat type
 - Planning region priority conservation actions by habitat type
 - Examples of suitable effectiveness measures
- *Appendices*
 - SGCN List (Elements 1 and 2)

2. APPROACH AND METHODS

Virginia's revised Action Plan utilizes a habitat approach to address threats and conservation actions for the state's fish and wildlife resources. This approach helps to ensure that conservation actions benefit a diversity of species within the Commonwealth. A habitat approach also allows for more species to be addressed by any single conservation action and for the more efficient use of limited resources. Additionally, this Action Plan is designed to facilitate implementation at a scale where conservation most often occurs – the local level. The novel approach of including Local Action Plan Summaries provides users the opportunity to “put themselves into the Plan” and understand what specific actions are needed to conserve species and habitats near where they live and work.

Throughout the process, DGIF administrators and the Action Plan's authors worked with the understanding that an effective Action Plan could only be created with input and guidance from DGIF staff, sister agencies, partner organizations, and the public. When creating the first Action Plan, DGIF established multiple teams and panels to build various portions of the Plan. While that process was effective, current circumstances and personnel limitations prevented the use of a similar process in developing a new Action Plan. Instead, the Action Plan's authors compiled draft materials for every aspect of the Action Plan and then reviewed those materials with staff and conservation partners to determine how those materials could be improved and refined. For some issues, this process required several iterations, but it did not require partners and staff to commit the same level of time and energy as the previous model. Draft materials created with partner input were then made available for public review and comment. Specifics of this process are detailed in the following sections.

SPECIES OF GREATEST CONSERVATION NEED LIST REVISION

Congress mandates that each Action Plan identify, “the distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deems appropriate that are indicative of the diversity and health of wildlife of the state” (USFWS 2006). These species are commonly referred to as Species of Greatest Conservation Need (SGCN). Within Virginia's original Wildlife Action Plan (2005), DGIF and partners identified 925 SGCN that represented 11 broad taxonomic groups. Because the updated Action Plan's SGCN list is based off the original list developed for the 2005 Wildlife Action Plan, it is important to understand how that list was created prior to describing the changes.

For the 2005 SGCN list, all animal species that use any terrestrial and/or freshwater habitats in the Commonwealth were considered for selection. This potential list included anadromous and catadromous fish, invertebrates, migrants, and all breeding or wintering species. To determine which species would actually be selected as SGCN, a matrix was developed that included all wildlife species in Virginia and their ranks on various lists of conservation concern. Species were divided into major taxonomic groups, and within each taxonomic group all SGCN were assigned a Tier ranking (1 to 4), based on rarity and imperilment.

Tier I. Critical Conservation Need. Faces an extremely high risk of extinction or extirpation. Populations of these species are at critically low levels, face immediate threat(s), or occur within an extremely limited range. Intense and immediate management action is needed.

Tier II. Very High Conservation Need. Has a high risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), or occur within a very limited distribution. Immediate management is needed for stabilization and recovery.

Tier III. High Conservation Need. Extinction or extirpation is possible. Populations of these species are in decline, have declined to low levels, or are restricted in range. Management action is needed to stabilize or increase populations.

Tier IV. Moderate Conservation Need. The species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a declining trend or a declining trend is suspected which, if continued, is likely to qualify this species for a higher tier in the foreseeable future. Long-term planning is necessary to stabilize or increase populations.

These four tiers became a starting point for review by the Taxonomic Advisory Committees (TACs). These standing committees, arranged by taxonomic group, were maintained by DGIF at the time of the 2005 Action Plan. The TACs were established to provide input on taxonomy, conservation, and other species issues. The TACs included Bird, Fish, Herpetofauna, Mammal, Mussel, and Invertebrate, the last of which included all non-mussel aquatic and terrestrial invertebrates. The final list was reviewed and modified as necessary by the TACs and then submitted to the internal and external steering committees for the 2005 Action Plan for approval as the final SGCN list.

While the original Tier system was sufficient to meet Congressional requirements, it proved to be insufficient to help DGIF and partners set and implement actionable conservation priorities. Threatened and endangered species often require many more resources and time with a smaller chance of recovery within a state than species that are less imperiled (AFWA 2012). To address this issue, the Association of Fish and Wildlife Agencies recommended adopting a triage approach, where costs, benefits, and likelihood of the conservation action being successful are considered together (AFWA 2012). Virginia's updated Action Plan builds upon the Tier ranking process from the original Plan by incorporating a Conservation Opportunity Ranking to document management needs and opportunities for each species.

Conservation Opportunity Ranking

In addition to a Tier ranking (see above), all SGCN are assigned a Conservation Opportunity Ranking (A, B, or C) in the updated Action Plan. These rankings are defined as follows:

- A – Managers have identified “on the ground” species or habitat management strategies expected to benefit the species; at least some of which can be implemented with existing resources and are expected to have a reasonable chance of improving the species’ conservation status.
- B – Managers have only identified research needs for the species or managers have only identified “on the ground” conservation actions that cannot be implemented due to lack of personnel, funding, or other circumstance.
- C – Managers have failed to identify “on the ground” actions or research needs that could benefit this species or its habitat or all identified conservation opportunities for a species have been exhausted.

Draft rankings were created based upon the 2005 Action Plan as well as any new information garnered through research and literature review to determine if more recent actions or plans have been developed for each of the SGCN. Draft materials were then provided to biologists and academic researchers knowledgeable of Virginia's species. This process enhances the original Tier system, and the increased number of categories allows the conservation community to better prioritize based upon actions that can be taken to address species' needs.

SGCN Review

In addition to modifying the species prioritization system, DGIF staff also reviewed and updated the SGCN list. To facilitate this review, the authors first reorganized the SGCN based on species type (mammals, birds, etc.) in an Excel spreadsheet. Each spreadsheet entry included: common name, scientific name, the 2005 Tier, and the draft Conservation Opportunity Ranking. The authors also included any relevant actions taken from the 2005 Action Plan, applicable research findings, and research needs identified either within the original Action Plan or from other sources. This effort resulted in a draft SGCN list and prioritization that was used to assist agency and stakeholder review. A comment section also was included for each species.

This Excel spreadsheet was provided to applicable DGIF staff and partners for review. Recipients were encouraged to share these draft materials with anyone they felt appropriate. Recipients of the draft materials were asked to review the species and consider whether the Tier and/or Conservation Opportunity Ranking should be modified based on their knowledge and expertise of the each species' biology and ecology. They were also asked to consider if any species should be removed from the SGCN list or added to the list based upon new information, changing circumstances, or management understanding. All proposed changes were accompanied by a justification based on a template designed by DGIF. Each justification required the following information:

- Complete contact information for the individual or official contact person for the agency or organization submitting the request.
- Common name and scientific name for the species in question.
- One sentence clearly indicating the change that is being proposed (e.g., Add ____ to the list of SGCN as a tier __ species, Remove ____ from the list of SGCN, or adjust the Tier ranking for (species) from Tier __ to Tier __.).
- A (maximum) two-page description indicating why the recommended change is being proposed. This should include reference to the tier/category definitions and justification for change should be in terms of population and/or habitat trends affecting the species in question. Additionally, the justification for a proposed change needs to:
 - Identify issues driving the population and/or habitat trends;
 - Quantify how those trends affect the perceived level of imperilment for that species in Virginia; and
 - Identify conservation actions that can be taken to address the issues impacting the species in question and/or its habitats.
- Relevant citations and copies of executive summaries (maximum of two pages) for peer-reviewed resources.

Once all input was received from DGIF staff and partners, the comments were taken into consideration. The SGCN list was revised based on all partner and public input (See Stakeholder and Public Participation).

HABITAT FOCUS

Throughout Virginia's original Wildlife Action Plan, habitat loss and degradation were identified as the most critical issues hindering SGCN conservation (DGIF 2005). Over the last decade, water quality degradation, habitat fragmentation, and habitat loss have become more acute and widespread. In 2013, DGIF conducted a review of game, fisheries, and diversity programs. This review recognized that a significant amount of game and nongame species are increasingly affected by the loss of, access to, or degradation of their habitats. Responding to these findings, DGIF administrators agreed it was necessary to focus more efforts on habitat conservation and habitat restoration (DGIF 2013). The updated Action Plan works to achieve this goal. By focusing on habitats and the suite of species that depend on each of them, more SGCN will benefit from individual conservation actions. Furthermore, focusing on habitats will enhance opportunities to work with a variety of partners within Virginia's conservation community.

A number of tools developed or identified by DGIF staff and partners have informed the habitat approach designed for the Action Plan. These resources assisted in defining habitats, describing the status of those habitats, as well as identifying threats and conservation priorities for habitats within the Action Plan. The primary materials include:

Northeast Terrestrial and Aquatic Habitat Maps and the Habitat Classification Guide (Anderson et al. 2013) – This classification system was designed by staff of The Nature Conservancy (TNC) and provides a map of aquatic and terrestrial ecological systems for the 13 states represented by the Northeastern Association of Fish and Wildlife Agencies. This system is hierarchical and identifies 121 ecological systems within the Northeast region which are organized into 35 macrogroups (Anderson et al. 2013). A significant portion of the Action Plan update involved reviewing TNC's data and compiling that information in ways that facilitate land management and habitat conservation. In addition to distribution, TNC's data describes how much of each habitat has been conserved by acquisition or easement, patch size, age class distribution, predicted loss due to development, and degree of connectedness among the individual habitat patches. This mapping system and its corresponding classification guide were used to develop regional habitat maps for the Local Action Plan Summaries (described below) and to help define the habitat groups used within this Action Plan. The 61 ecological systems present in Virginia were reorganized into approximately 8 habitat groups (e.g., wetland, mixed hardwood/ conifer forest, open habitat, etc.) that align with the Commonwealth's resource management efforts.

Virginia Water Quality Improvement Plans (DEQ 2014) – Virginia's Department of Environmental Quality (DEQ) monitors water quality throughout the Commonwealth. When water quality problems are identified, watersheds are designated as impaired based upon the load of a variety of physical and chemical factors (e.g., nitrogen, phosphorus, fecal coliform, etc.). Many of the impaired watersheds require a metric known as a Total Maximum Daily Load (TMDL). A TMDL designates a maximum acceptable load of the chemical and physical inputs that a watershed can accommodate without posing a risk to human health or other resources. When a TMDL has been established for a watershed, DEQ staff, in collaboration with communities, partners, and private individuals, work to create a Water Quality Improvement Plan that identifies the types of impairments impacting a watershed, the sources of those impairments, and what actions can be taken to address those impairments. Many of the water

quality issues discussed within the TMDL designations and subsequent plans are consistent with threats and conservation actions identified within Virginia's first Wildlife Action Plan and modern discussions with conservation partners. Commonly prescribed conservation actions in the Water Quality Improvement Plans include restoring riparian buffers, working to exclude cattle from streams, reducing nutrient-laden runoff, revegetating upland sites, and reducing erosion. In addition to improving water quality, these actions also benefit a great diversity of aquatic and terrestrial SGCN. Absent other priorities, the updated Wildlife Action Plan treats watersheds with Water Quality Improvement Plans as priority areas for aquatic and riparian habitat restoration efforts.

Virginia Watershed Integrity Model (Ciminelli and Scrivani 2007) – In 2007, the Virginia Department of Conservation and Recreation's Division of Natural Heritage, the Virginia Department of Forestry, the Virginia Commonwealth University Center for Environmental Studies, and the Virginia Coastal Zone Management Program developed the *Virginia Watershed Integrity Model* to identify land-based areas that should be conserved to help improve or maintain water quality. Water quality is greatly influenced by adjacent land use, and this model's inputs focus on terrestrial factors that influence water resources and watershed integrity. These inputs include information related to headwater streams, drinking water sources, ecological core information, stream/ river/ floodplain data, and indices of biological integrity. The model compiles this information to rank watersheds across the state in terms of their integrity value. The model outputs are meant to help target conservation efforts, prioritize or provide justification for acquisition and protection, assist with local planning, help with project assessments, be used by land managers, and provide an education resource. The watershed integrity model is used within this Action Plan to identify high quality watersheds that may be conservation priorities within individual planning regions. It is important to note that this model is currently being updated, and new material should be available during 2016. The maps found within this Action Plan were created from the 2007 data. As new maps become available, they will be included in the Action Plan's online version.

Virginia Wetlands Catalog (Weber and Bulluck 2014) – In 2014, staff with Virginia Department of Conservation and Recreation's Natural Heritage Program completed an inventory of wetlands and potential wetlands within the Commonwealth. This inventory is known as the Virginia Wetlands Catalog and was developed to identify and prioritize wetlands based upon their habitat value and ecological function. These data are used to identify high quality wetlands that are considered a priority for conservation as well as degraded wetlands that could be improved or restored with conservation actions. The conservation and restoration priorities identified in this catalog informed development of wetland specific conservation priorities in the Local Action Plan Summaries.

SGCN Watershed Distribution Maps – Within Virginia's original Action Plan, authors provided distribution maps for the most critically imperiled SGCN. These maps include buffered point locations where individual animals had been documented as well as areas designated as potential habitat. While these maps were informative, they were limited in their ability to inform multi-species conservation actions. In 2009, DGIF staff developed new distribution maps for each SGCN identified within the original Action Plan whose distribution was known. These new maps were based on fine scale watersheds referred to as HUC12 watersheds (Weary and Doctor 2014). Virginia's HUC12 watersheds range in size from approximately 15 square miles to 70 square miles. Each of Virginia's counties typically encompasses 10 to 15 HUC12 watersheds. HUC12 maps were created for approximately 500 of the original 925 SGCN. The majority of these were vertebrates, freshwater mollusks, and crayfish. By mapping SGCN distributions within HUC12 watersheds, the updated Action Plan is able to identify areas that support multiple SGCN (Figure 2.1). Likewise, HUC12 maps are at a fine enough scale to identify priority areas within a county or planning region, but at the same time are coarse enough to hinder

illegal collections or be perceived as a threat to private landowners. SGCN distribution maps are provided in each Local Action Plan Summary.

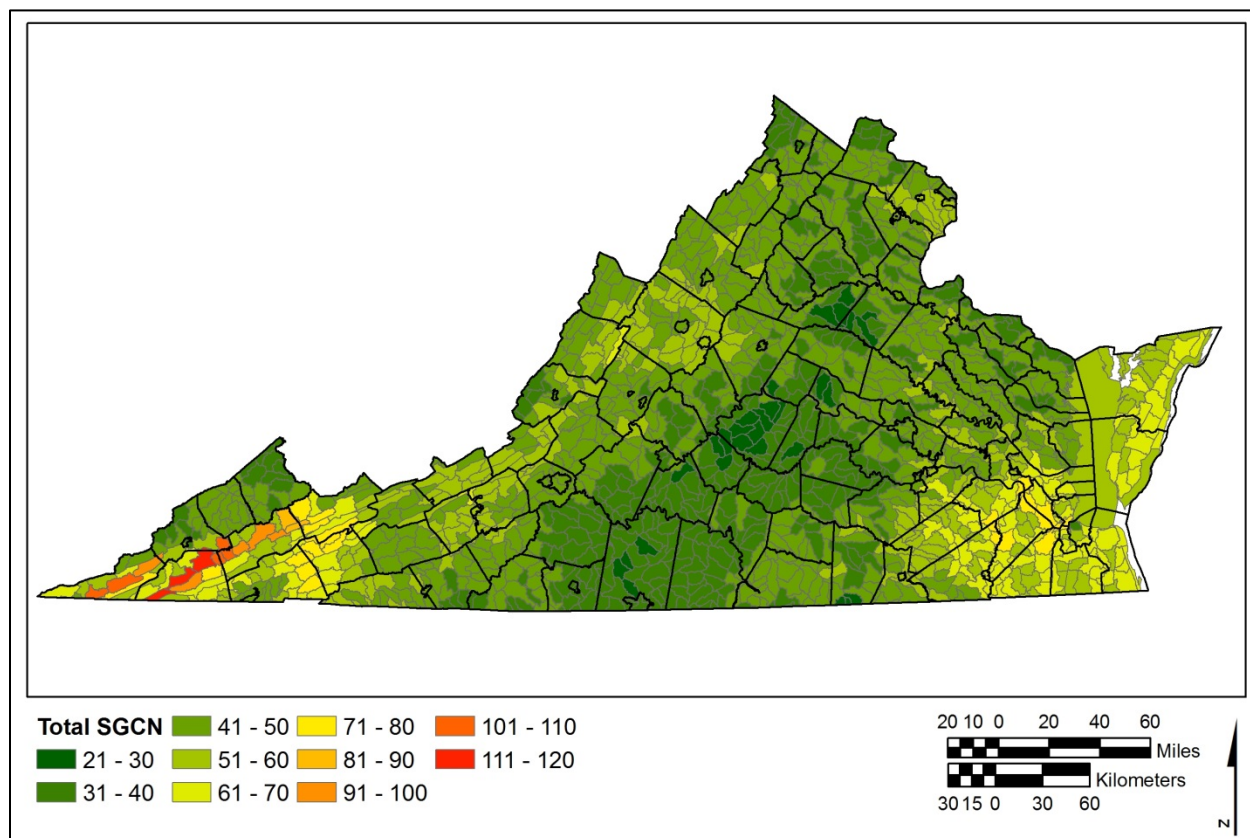


Figure 2.1. SGCN Density by HUC12 Watersheds.

Northern Bobwhite Quail Action Plan for Virginia (DGIF 2007) – In 2007, responding to a dramatic loss of open habitats and the subsequent declines in northern bobwhite quail and other open habitat species, DGIF staff and partners completed Virginia’s first Quail Action Plan (DGIF 2007). This document identifies six focus areas where habitat restoration efforts are focused. Although quail are a primary focus, it has always been DGIF’s assertion that providing habitats suitable for quail will also benefit scores of SGCN that utilize glade, grassland, savanna, and shrubland habitats. Absent other priorities, efforts to conserve and restore open habitats within the Action Plan will focus on these six priority areas.

Management-Based Habitat Categories

Habitats are often described by managers at the scale in which they work. To determine the habitat categories appropriate for the Action Plan, the authors first reviewed available literature and developed a brief description of each SGCN’s habitat requirements. This process relied upon data from the Virginia Fish and Wildlife Information System (<http://vafwis.org/fwis/>), the Audubon Society’s Online Guide to North American Birds (<http://www.audubon.org/field-guide/bird/>), Freshwater Fishes of Virginia (Jenkins and Burkhead 1993), and the NatureServe Explorer (<http://explorer.natureserve.org/>). Using this information, the authors drafted a list of potentially important SGCN habitat types within the state. The authors organized a series of meetings with DGIF staff from across the state to review the draft materials and discuss how they could be improved. The authors also met with key conservation partners to further refine the habitat list. Priority habitats discussed during these meetings included:

- Marine habitats
- Dunes, Beaches, and Mudflats
- Tidal wetlands
- Non-tidal wetlands
- Freshwater aquatic and riparian habitats
 - Tidally influenced warm water streams and rivers
 - Coldwater streams and rivers
 - Non-tidal warm water streams and rivers
 - Blackwater streams and rivers
- Open habitats
- Piedmont and coastal mixed hardwood/ conifer forests
- Western mixed hardwood/ conifer forests
- High elevation forests (spruce and other high elevation)
- Karst and subterranean habitats
- Other fine-scale microhabitats

During each of the habitat meetings, participants were asked to help identify threats impacting each of these habitats, describe actions that could be taken to address those threats, and identify any priority areas or micro-habitats that should be specifically identified within the updated action plan. Descriptions of each habitat type are provided within the Statewide Section. The Northeast Terrestrial Habitat Map was used to map the primary habitat types for each Local Planning Region Summary.

LOCAL ACTION PLAN SUMMARIES

Since Virginia's original Action Plan was completed, a number of DGIF staff and partners expressed concerns regarding its format. Many found the Action Plan difficult to use and, thus, were unable to identify local priorities and develop "on the ground" projects to address conservation needs. DGIF recognized this issue and has worked to address it by incorporating Local Action Plan Summaries (Local Summaries) into this version of the Action Plan.

Each of these Local Summaries will provide localities with information regarding priority SGCN, the habitats those species require, threats impacting species and/or habitats, and actions that can be taken to address those threats. Whenever possible, each Local Summary will indicate which areas have been identified as being a priority either for conservation or for restoration efforts.

To achieve this goal, DGIF adopted a model developed by the Virginia Department of Conservation and Recreation (DCR) for the Virginia Outdoors Plan (DCR 2013). The Virginia Outdoors Plan describes recreational resource issues for 21 multi-county Recreational Planning Regions (Figure 2.2). Each Recreational Planning Region is roughly analogous to one of Virginia's 21 Planning District Commissions (PDC).¹ The PDCs are voluntary associations of local governments established to foster intergovernmental cooperation by bringing together local officials, agency staff, the public, and partners to discuss common needs and develop solutions to regional issues.

¹ More information on Planning District Commissions can be found at: (Virginia Association of Planning District Commissions, <http://www.vapdc.org/?page=About>).

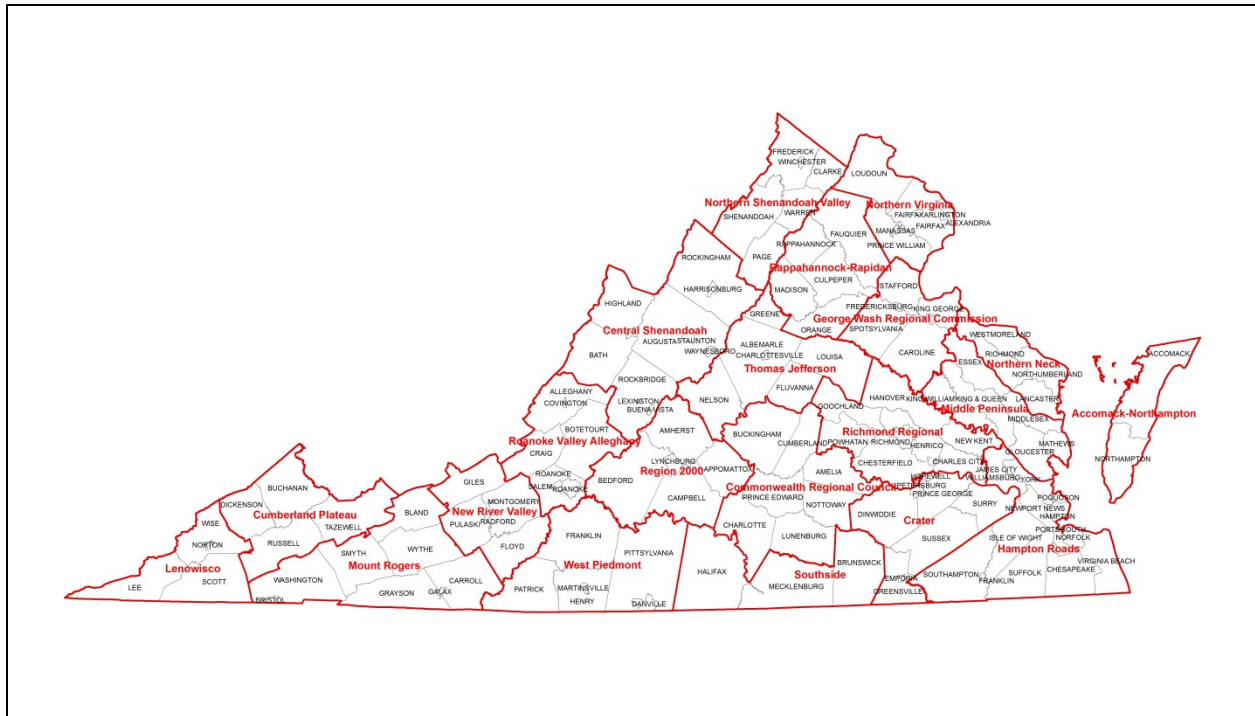


Figure 2.2. Local Planning Regions.

With its focus on local-scale actions, the Virginia Outdoors Plan has become an important tool for identifying and addressing local recreational issues. By using DCR’s model to identify and address local wildlife and habitat issues, it is anticipated that the updated Action Plan will complement and enhance an existing planning infrastructure, better identify local priorities and multi-species conservation opportunities, and facilitate “on the ground” conservation actions that benefit local communities and their local wildlife resources.

Local Summary Development

The Local Summaries were developed through a multi-year iterative process, involving DGIF staff and the Conservation Management Institute (CMI) at Virginia Tech. The need for a scaled-down, locally relevant summary of Action Plan information was first articulated in 2009 within *Virginia’s Strategy for Safeguarding Species of Greatest Conservation Need from the Effects of Climate Change* (a companion document to the original Action Plan that identified 10 initial climate change adaptation strategies) (DGIF et al. 2009). Summaries were identified as an important resource needed to identify local conservation issues and support implementation of local conservation efforts.

Local Summaries use information from the original Action Plan, new species distribution maps, and other input gathered through modeling, research, and meetings with both DGIF staff and partners. Specific data included in each Local Summary are described below. DGIF staff and partners were also given the opportunity to review and provide input on the early draft versions of the Local Summaries, during the Action Plan update process. The Local Summaries were revised based upon this review. Revised Local Summaries were a part of full Wildlife Action Plan draft that was provided to conservation partners and the public for review in spring of 2015. All comments and revisions were considered for inclusion.

Priority SGCN within the Local Summaries

The Local Summaries focus attention on those SGCN for which the individual planning region comprises a significant portion of the Virginia range. First, SGCN distribution maps (see Habitat Approach) were used to identify which SGCN occur within each of the 21 planning regions by HUC12 watersheds. The entire SGCN list for each planning region is included as Appendix A within each Local Summary. In some cases, hundreds of species were identified as occurring within an individual planning region. Upon reviewing the local SGCN lists and conferring with partners, it was determined that the initial local SGCN lists were too long to provide a meaningful prioritization, because these lists included numerous species that were on the fringe of their range. As such, the authors implemented a 10 percent rule to identify locally important species. Under the 10 percent rule, an SGCN is included in a Local Summary if the planning region provides at least 10 percent of that species' range in Virginia. This modification reduced the size of many SGCN lists by half or more and allows local conservationists to focus efforts on those species for which they can make the greatest impact.

It should be noted that the 10 percent rule is arbitrary. In discussions, DGIF staff and partners recommended using values ranging from 2 percent to 40 percent. A literature review and follow-up discussions failed to provide any significant guidance as to what value would be most appropriate. Lacking additional input or peer-reviewed justification, DGIF's Wildlife Action Plan Coordinator selected 10 percent as it produced manageable SGCN lists and was acceptable to the majority of staff and partners.

While updating the Action Plan, the 10 percent rule was modified, in specific instances, to address several issues. First, some SGCN occur statewide but in low numbers in each planning region. As such they will never reach the 10 percent threshold in any single planning region. When these incidents were identified, the Action Plan authors worked with DGIF staff and others to determine which planning regions were most appropriate, and the species was manually added to those local lists of priority species. Some species only occur in three or fewer planning regions. These SGCN are also included on priority lists due to their rarity in the state and the importance of those few planning regions to its survival. In several instances, significant properties have been conserved to provide habitats for migratory species. While an individual species may only be in Virginia for a matter of days, these migratory habitats are considered critical for their long-term conservation. When these circumstances were identified, specific migratory species were manually added to local SGCN lists. Finally, partners identified instances where a species may have a particularly strong population in a relatively small portion of a planning region. While the species might not reach the 10 percent rule for that planning region, the specific populations in question were determined to be significant enough to warrant inclusion on the local priority SGCN list. Again, when these circumstances were identified, species were manually added to the local priority SGCN list.

For each priority SGCN, Tier and Conservation Opportunity Ranking and primary habitat descriptions are included within each Local Summary. Maps depicting the highest density of SGCN throughout each planning region are also included in an effort to help understand where the most species would be conserved or would benefit from conservation action.

Priority Threats and Conservation Actions within the Local Summaries

Threats and conservation actions are described at a habitat level within each Local Summary. To develop these sections, the authors first referred to the original Action Plan, reviewing the threats and actions outlined for the Tier I SGCN and the overall threats and actions described in the 2005 Action Plan's appendices. The greatest threats to the majority of species involve the loss or degradation of habitats. Common causes include fragmentation, nonpoint source pollution, and land development. The authors summarized this information and used it as a baseline for discussions with DGIF staff and partners at meetings to discuss priority habitats (see above). The outcome of these meetings indicated that Virginia's Action Plan could be revised with a greater habitat focus and that implementing habitat conservation and restoration activities could be a viable means of conserving multiple SGCN simultaneously.

The habitat-based meetings were held across Virginia. DGIF staff members who have experience with a particular habitat were invited to each relevant meeting. Many DGIF staff attended multiple meetings. The meetings were structured to elicit feedback from staff on how to divide and describe habitats as well as review the initial list of threats and actions to the habitats. The goal of these meetings was to gain a better understanding of how managers within the state categorize habitats, what they see as threats to habitats, and the conservation actions that could address those threats. The last part of these meetings was focused on working to identify priority areas for conservation actions. The Action Plan authors held 12 meetings with DGIF staff to discuss aquatic and terrestrial habitats. Another 10 meetings were held with conservation partners to discuss specific habitat types and conservation areas. These meetings included discussions with staff from the National Wildlife Refuges in Virginia, USFWS Virginia Offices in Gloucester and Abingdon, the Virginia Department of Forestry (DOF), the U.S. Forest Service (USFS), the Natural Resources Conservation Service (NRCS), The Nature Conservancy (TNC), the Xerces Society, and DCR Natural Heritage program. Meetings with other organizations were requested but could not be arranged (see Stakeholder and Public Participation). Finally, additional threats, actions, and priorities were identified during the Action Plan review process.

Within the Local Summaries, priority habitat types present within the planning region were determined from the local SGCN list (see above). As each SGCN entry includes a basic description of habitat needs, species can be grouped into basic habitat-oriented categories (e.g., wetlands, riparian, open habitats, karst, etc.). Each Local Summary includes a brief narrative that identifies the primary threats impacting each priority habitat within each planning region. Threats were identified from the habitat meeting notes and resources provided by meeting participants. Local Summaries also describe priority conservation actions that can be taken to address the identified threats. These conservation actions were also developed based on habitat meeting notes as well as resources provided by meeting participants, partners, and other resources.

CLIMATE CHANGE

Climate change is a stressor that will exacerbate most other existing threats and affect management actions over the long-term (Klopfer et al. 2012; Kane et al. 2013). The original Action Plan indicates climate change threatens several SGCN; however, the issue is not extensively addressed. In an effort to consider climate change impacts on wildlife and habitats within the state, DGIF began working with the National Wildlife Federation and Virginia Conservation Network in 2008. Together, they planned two

workshops to bring together key partners within Virginia to discuss climate change and conservation. Over 35 groups and agencies participated in this process to create *Virginia's Strategy for Safeguarding Wildlife from Climate Change* (DGIF et al. 2009). The 2009 climate change strategy identified 10 specific recommendations ranging from habitat conservation to research to outreach.

A key research recommendation called for more Virginia-specific climate change information and details about how climate change is likely to impact Virginia's species and habitats. Based on this recommendation, DGIF worked with CMI and the National Wildlife Federation to develop new climate models and conduct a species vulnerability assessment. This project was designed to create spatially explicit climate forecasts, determine the magnitude and occurrence of future climate changes within the Commonwealth, and describe the impacts that those climate changes may have on the distributions of a selection of SGCN and their habitats. Once the climate data were generated and vulnerability assessment was complete, the data were used to go a step further and consider landscapes and habitat conservation more broadly. This effort culminated in the Virginia Conservation Lands and Climate Assessment.

Conservation Lands and Climate Assessment

Habitat loss and habitat degradation are the greatest threats impacting the Commonwealth's SGCN. To help address these threats, Virginia's conservation community has made significant investments to conserve lands that can be managed to provide SGCN with habitats. Unfortunately, recent climate change research and related species vulnerability assessments (Klopper et al. 2012; Kane et al. 2013) indicate habitat-related issues could become more acute as climatic conditions change. In addition, landscapes will likely be subjected to changing land use patterns driven by the need for ecosystem goods, increased agricultural production, and expanding human development (Klopper and McGuckin 2015).

During the last century, state and federal agencies, as well as NGO partners, have made significant investments to acquire lands and create wildlife management areas, parks, refuges, and easements to conserve important habitats, provide recreational opportunities, and conserve priority species, including SGCN. These parcels, in aggregate, comprise a "conservation lands portfolio" and provide the backbone for SGCN management strategies in Virginia. Previous studies have indicated many of the nation's priority species are vulnerable to climate change, and that climate change could have profound impacts on conserved lands and the habitats they provide throwing the long-term viability of this portfolio, and conservation strategies dependent on them, into question (Klopper and McGuckin 2015).

In order to better understand these issues and how land management efforts might be adapted to address these changing circumstances, DGIF partnered with Virginia Tech's Conservation Management Institute (CMI) to implement the Conservation Lands and Climate Assessment project (Klopper and McGuckin 2015). Per this effort, CMI compiled and analyzed existing data regarding conserved lands, current climatic conditions, and projected future climatic conditions to assess how climatic conditions are expected to change across Virginia and what impacts those changes could have on the conservation lands portfolio/ network (or CLN).

Existing information from the Virginia Conservation Lands Database (VCLNA) was combined with climate data provided by the WorldClim climate data portal (<http://www.worldclim.org/>) and the CMIP5 (Coupled Model Intercomparison Project Phase 5 (CMIP5) global climate model used in the 5th International Panel on Climate Change. These datasets provide modeled climate scenarios at multiple

spatial scales and time periods (Hijmans et al. 2005). This project also used the “bioclimatic” set of information for both the current and modeled climate data. This set contains 19 variables that have been used in assessing climate impacts on biodiversity designed to assess annual and seasonal climate factors as well as extremes (Hijmans et al. 2005). This analysis used both the annual mean temperature (BIO1) and annual mean precipitation (BIO12) for the study area. The final analysis compares data from 2000 (current) and predictions for the year 2070 (Klopfers and McGuckin 2015). Temperature and precipitation data for 2000 were combined to create a potential 81-class map covering the majority of the Eastern U.S.; although, only a fraction of these climate classes occur in Virginia. This same process was applied to the temperature and precipitation data for the 2070 climate layer.

This assessment is used to highlight how conditions may change within Virginia and projected representation of conservation lands within each climate class in the future so that managers may understand the types of habitats and species that may or may not be resilient and/ or vulnerable as conditions change on existing conservation lands in Virginia. Each parcel of conserved land was evaluated to determine if climatic conditions related to temperature and precipitation are expected to change and how significant those changes are expected to be. This process allowed researchers to summarize the total area of each climate class that was protected by the CLN or not. It also allowed for a comparison of the total composition and change between climate classes at each time period to determine which climate classes would likely be lost, gained, or remain the same within the CLN in 2070. All of these analyses were completed using Microsoft Excel from tables that were exported from the GIS (Klopfers and McGuckin 2015).

This project attempts to illustrate how climate change information can be used to assess climate-related changes on the landscape and related impacts to natural resources. This will likely yield the greatest information when applied under a specific set of circumstances for a particular purpose. Our results are general, but can be easily applied to more specific information needs. This type of information may be useful in informing species-specific climate mitigation adaptation planning. While this analysis has provided some information on where suitable climate conditions may exist in the future, it did not attempt to determine whether species could be expected to shift along with the climate class. Species movement across the landscape is highly dependent on localized factors, so while suitable conditions may be found elsewhere in the study area there is no guarantee that species will be able to access it. Therefore, this information could be an integral part of conservation planning to determine what sorts of targeted management actions would be necessary to establish species populations. Techniques such as assisted migration, corridor design, vegetation management, or other efforts can be considered using the information provided with this technique.

This Action Plan also uses climate change data in two other capacities. First, climate change information is presented within the Statewide Threats Section. This material outlines projected impacts across Virginia and how these changes may impact SGCN and habitats. Climate change is also integrated into each Local Summary. For each priority habitat, the Local Summary includes any relevant climate change-related threats and provides a description of “climate-smart” actions that can be taken to help ensure the benefits of conservation actions in the face of changing climatic conditions.

MONITORING, EFFECTIVENESS MEASURES, AND RESEARCH NEEDS

Monitoring

In terms of monitoring, an Action Plan must describe how each state will monitor the status of species and habitats that have been included within the Action Plan. Information on monitoring within the Action Plan must also identify the mechanisms that will be used to monitor the effectiveness of conservation actions implemented on behalf of the Action Plan. Finally, each Action Plan must describe the mechanisms that will be used to adapt conservation actions in response to new information or changing conditions. While distinct, these concepts are related. Ideally, over time, conservation actions that are implemented will produce detectable improvements for local wildlife populations and/ or their habitats. While the benefits of some projects might not be fully realized for years or even decades, monitoring the changes achieved from conservation efforts will make it possible to evaluate the conservation community's ability to achieve conservation goals. Additionally, information from monitoring will allow managers to adapt those efforts to be more effective as experience is gained and changes are observed. DGIF staff and partners used the following mechanisms to address monitoring within Virginia's second Action Plan.

Monitoring Species Status

Virginia is home to over 30,000 species. These include vertebrates, invertebrates, aquatic, terrestrial, marine, karst, and migratory species. With available resources, it is impossible to maintain an accurate census of this many populations. As an alternative, DGIF staff work with multiple partners to collect species data that are incorporated into data systems and the Action Plan. These efforts include:

Population Monitoring by DGIF Staff – DGIF field staff spend many months each year collecting data on wildlife populations. DGIF staff may also hire academic institutions or private entities to collect species data on the agency's behalf. In many cases, data collection efforts are iterative multi-year projects. Much of the data collected are incorporated into the Virginia Fish and Wildlife Information System – a publicly available database that allows access to data and information about Virginia's wildlife. Among other uses, these data inform species management efforts and the environmental review process. These data, in conjunction with other information, were used to determine if a species should be included within Virginia's Wildlife Action Plan and how a species should be prioritized within the Tier structure (see Methods – Species of Greatest Conservation Need List Revision). Results of individual data collection and species monitoring efforts are reported in annual reports for State Wildlife Grants and Wildlife Restoration Grants provided to the USFWS. Examples of recent monitoring efforts funded with State Wildlife Grants and other resources include the blackbanded sunfish in southeast Virginia, freshwater mussel populations in Copper Creek and other portions of the Clinch River, the Atlantic Sturgeon in the Chesapeake Bay watershed, and beach nesting species on Virginia's beaches and barrier islands.

Scientific Collection Permits – DGIF is responsible for regulating the collection of wildlife-related data by researchers and partner organizations within the Commonwealth. The permitting process requires that species distribution data collected during projects performed by permitted individuals be submitted to DGIF annually. These data are reviewed for accuracy and then incorporated into the Virginia Fish and

Wildlife Information System – a publicly available database. These data are also used to determine if species should be included within Virginia’s Wildlife Action Plan and how a species should be prioritized within the Tier structure (see Methods – Species of Greatest Conservation Need List Revision).

NatureServe Status Rankings – NatureServe is an international nonprofit organization that works to answer four questions: What species and habitats exist? Where are they found? How are they doing? And which are conservation priorities? NatureServe provides a standardized set of global status rankings for species and habitats. These are commonly referred to as the “G&S” ranks. “G” represents “global” status, and “S” represents “state” status. Both the global and the state rankings utilize a 5-point ranking criteria. A score of 5 indicates a species is “Secure”, a score of 4 indicates a species is “Apparently Secure”, a score of 3 indicates a species is “Vulnerable”, a score of 2 indicates a species is “Imperiled”, and a score of 1 indicates a species is “Critically Imperiled.” The state ranking might also include SH, which indicates a species is “Possibly Extirpated,” or a value of SX indicates a species is “Presumed Extirpated” in Virginia. The S ranks are maintained by the DCR Natural Heritage Program, a member of the NatureServe Network. NatureServe rankings are generally consistent with the Action Plan’s Tier system.

Monitoring Habitat Status

Water Quality

The National Clean Water Act requires each state to monitor the quality of its surface and ground waters to determine if they support six designated uses, including aquatic life, fish consumption, public water supplies (where applicable), recreation (swimming), shellfishing, and wildlife (DEQ 2014). Virginia also has instituted subcategories under most of these designated use categories. The U.S. Environmental Protection Agency (USEPA) requires that DEQ prepare biennial reports (305(b)/303(d) Water Quality Integrated Report), describing the status of water quality within the state (DEQ 2014). During the course of their water quality monitoring to prepare these reports, DEQ personnel gather data from 4,328 stations located in Virginia’s lakes, reservoirs, rivers, and estuaries. The types of data collected include measurements of temperature, pH, dissolved oxygen, nutrients, suspended solids, bacteria, metals, pesticides, herbicides, and toxic organic compounds. These data allow individual waters to be classified into one of five groups:

- Category 1: Water that fully supports all designated uses.
- Category 2: Water that fully supports some designated uses, but there is either insufficient or no information regarding the remaining designated uses.
- Category 3: There is insufficient information to determine if designated uses are being met.
- Category 4: Waters are impaired or threatened but do not need a TMDL.
- Category 5: Waters are impaired and need a TMDL.

The Water Quality Integrated Report is transmitted to Congress and the USEPA. Based on water quality monitoring and the degree of impairment, a watershed may require a Total Maximum Daily Load (TMDL) figure be calculated (see Statewide Overview; Freshwater Aquatic and Riparian Habitats). The most seriously impaired waters require a Water Quality Improvement Plan (see Statewide Overview; Freshwater Aquatic and Riparian Habitats). Virginia’s list of impaired waters and the available water quality improvement plans are available online (DEQ 2014).

Virginia's Healthy Waters Initiative

Virginia's Healthy Waters Initiative, a joint effort of the DCR, Virginia Commonwealth University, and DEQ, is an effort to broaden conservation efforts to maintain critical, healthy resources before they are compromised. This Initiative is meant to work in concert with water quality programs that focus on repairing degraded systems to protect living resources. The approach encompasses protecting everything from aquatic insect larvae and bugs hidden in gravelly stream bottoms to forested buffers alongside streams to natural stream flows to the water we drink in an effort to maintain ecological balance. Healthy streams in Virginia have been identified and ranked through a stream ecological integrity assessment known as the Interactive Stream Assessment Resource (INSTAR). Streams may be ranked as "exceptionally healthy," "healthy," or "restoration candidate." Developed by the Center for Environmental Studies at Virginia Commonwealth University, INSTAR is an online interactive database application that identifies healthy streams using stream data that includes information about fish communities and insects, in-stream habitat, and riparian borders. Healthy waters are incorporated into DCR's Natural Heritage Biotics Database and used for land conservation and land planning purposes.

Virginia Wetlands Catalog

The Virginia Department of Conservation and Recreation/Natural Heritage Program, working with the Natural Resources Conservation Service, the Virginia Department of Transportation, The Nature Conservancy, and Virginia Commonwealth University's Center for Environmental Studies, has developed the Virginia Wetlands Catalog. This tool considers the condition and status of wetlands and ranks them in terms of restoration or conservation priority. Wetland patches are evaluated on several factors, including existing plant and animal diversity, presence of significant natural communities, presence of natural lands providing ecosystem services, presence of corridors and stream buffers, proximity to conserved lands, inclusion within or downstream of healthy watersheds, and location of drinking water sources, proximity to degraded watersheds, proximity to impaired waters, location of existing wetland mitigation banks, presence of prior converted and farmed wetlands, and inclusion of stream reaches with lower aquatic biodiversity (Weber and Bulluck 2014). This material provides the most extensive set of habitat quality data available for Virginia's wetlands, and it is used to identify priority areas for wetlands conservation and wetlands restoration within each of the Local Summaries.

Chesapeake Bay Fish Prioritization Tool and the Southeast Aquatic Connectivity Assessment Tool

Many of Virginia's rivers are fragmented by dams, culverts, and other impediments that limit the connectivity of these aquatic habitats. This fragmentation can prevent aquatic species from accessing important aquatic habitats crucial to various life stages. Stream restoration and connectivity projects (e.g., removing dams and culverts or modifying them to allow for passage) help improve and provide additional aquatic habitats for fish species within the state; however, there are many dams, and not all can or should be removed. In recent years, two tools have been developed to explore this issue. The Chesapeake Bay Fish Passage Prioritization Tool was designed by The Nature Conservancy in coordination with the NOAA Restoration Center, the U.S. Fish and Wildlife Service's Maryland Fisheries Resource Office, and other partners (Martin and Apse 2013). The Southeast Aquatic Connectivity Assessment Tool was designed by The Nature Conservancy in coordination with the Southeast Aquatic Resource Partnership, the South Atlantic Landscape Conservation Cooperative, and other partners (Martin et al. 2014).

Both tools were created to evaluate the ecological return on investment of restoring connectivity in streams and rivers. Dams were assessed in terms of their ability to provide ecological benefits for one or more species if removed or altered to allow fish to bypass. Contributors to these tools prioritized dams for removal throughout the study areas based on benefits to three target groups of species – diadromous fish, resident fish, and brook trout. A wide range of metrics were developed and assessed for each of the three targets to help identify which dams were of highest priority for each of the three targets. Metrics for diadromous fish included amount of upstream river length available; upstream and downstream barriers, amount of impervious surface, amount of natural landcover, stream health, and number of diadromous species in the stream network, etc. The prioritization tool for diadromous fish was used to identify the top 3 tiers (top 15%) of priority dams for removal or alteration within Virginia. Most of these dams fall within the Coastal Plain region. Within this Action Plan, where a planning region contains high priority dams for removal or modification, these priorities are identified within its Local Summary, and a map is included to indicate which watersheds would benefit from enhanced connectivity.

Forest Inventory and Analysis

The National Forest Inventory and Analysis effort uses remote sensing data and field data from permanent, confidential plots to determine change in forest cover and productivity (timber volume) nationwide. There are 4,691 permanent plots in Virginia (Rose 2011). Each plot is surveyed once every five years, so that all plots are covered over a five-year survey cycle. Data recorded at each plot include forest type, ownership, tree volume, individual tree species, age, diameter, height, condition, and presence of invasive species. Because this survey effort began in 1940, many changes in methodology have occurred since its inception. These changes make it difficult to draw small-scale (i.e., local) conclusions about trends from these data. However, trends involving multiple planning regions, as well as statewide and national trends, are available.

Northeast Terrestrial Habitat Map

In 2013, The Nature Conservancy, working on behalf of the Northeast Association of Fish and Wildlife Agencies and the North Atlantic Landscape Conservation Cooperative completed *Northeast Habitat Guides: A Companion to the Terrestrial and Aquatic Habitat Maps* (Anderson et al. 2013). This document and the habitat classification system it describes were developed “...as a comprehensive and standardized representation of habitats for wildlife that would be consistent across states and consistent with other regional classification and mapping efforts” (Anderson et al. 2013). As part of each habitat’s description, the authors indicate in which states the habitat occurs, how many acres occur within each state, and how many of those habitat acres are managed as some form of conserved land. This report also provides tables indicating patch size, age class distribution, likelihood of loss due to development, and degree of fragmentation. These data provide a snapshot of status for habitats restricted to Virginia, and provide a general overview of status information for habitats that occur more broadly across the Northeast. The status information provided within the Terrestrial habitat map report is supplemented by additional information provided within *Conservation Status of Fish, Wildlife, and Natural Habitats in the Northeast Landscape: Implementation of the Northeast Monitoring Framework* (Anderson et al. 2011).

Natural Communities of Virginia: Classification of Ecological Community Groups

DCR's Natural Communities of Virginia: Classification of Ecological Community Groups is a classification system that represents assemblages of co-existing, interacting species, considered together with the physical environment and associated ecological processes that usually recurs on the landscape. DCR's natural community inventory and classification represent an important "coarse-filter" approach to biological conservation that ensures the protection of intact ecological systems containing diverse organisms. By identifying and protecting excellent examples of all natural community types in Virginia, the majority of our native plant and animal species, including many cryptic and poorly known ones, can be protected without redundant individual attention (Fleming et al. 2013). More information and detailed classification descriptions and images can be found online at http://www.dcr.virginia.gov/natural_heritage/natural_communities/nctoc.shtml.

Measuring the Effectiveness of Conservation Actions

Since Virginia's original Action Plan was completed, monitoring and reporting the effectiveness of conservation actions has become an increasingly important issue. In late 2005, the U.S. House of Representatives initiated a performance review of the USFWS's Wildlife and Sportfish Restoration Programs, including State Wildlife Grants. This report concluded that results, related to the effectiveness of conservation actions, "are not being demonstrated". In subsequent years, funding for State Wildlife Grants has been scrutinized regarding its value to the American public. The USFWS and state wildlife agencies have worked to develop a mechanism to describe the importance and value of this program and the Wildlife Action Plans. In September of 2009, the Association of Fish and Wildlife Agencies (AFWA) recruited staff from a diversity of state wildlife agencies and nongovernmental organizations to develop and test a framework of effectiveness measures to support the State Wildlife Grants program and the implementation of Action Plans. This framework of effectiveness measures was designed to:

- *Provide a means to evaluate conservation actions so that successful activities/programs can be continued and communicated and less successful ones improved or abandoned;*
- *Establish a standardized and accessible body of project performance data to inform and guide actions by current and future wildlife managers; and*
- *Provide a cost-effective mechanism for reporting data through regional and national summaries that will help meet congressional reporting expectations and articulate the value of state wildlife grants, and potentially the wildlife action plans, to policy makers, conservation partners, and taxpayers (AFWA 2011).*

The final Effectiveness Measures report identifies 11 basic conservation actions that have been implemented by states to support their Wildlife Action Plans (AFWA 2011). These include:

- Direct Management of Natural Resources;
- Species Restoration;
- Creation of New Habitat;
- Acquisition/Easement/Lease of Land;
- Conservation Area Designation;
- Environmental Review;
- Management Planning;

- Land Use Planning;
- Training and Technical Assistance; and
- Data Collection and Analysis.

For each project type, the working group used a planning tool called a Results Chain to identify intermediate output measures that can be used to evaluate the quantity and quality of work completed during a project's implementation (FOS 2007). Each results chain also identified longer-term outcome measures that are used to evaluate how successful a project is in meeting its intended goals.

This working group's final report was completed and approved by the AFWA Executive Committee in April 2011. Subsequently, the USFWS's branch of Wildlife and Sport Fish Restoration (WSFR) adopted this framework and coordinated with AFWA and state agency partners to incorporate these measures into the Tracking and Reporting on Actions for Conservation of Species (Wildlife TRACS) reporting system. Once fully operational and implemented, Wildlife TRACS will serve as the mandatory, central repository for all projects implemented using State Wildlife Grant and other WSFR grant programs. As the Wildlife TRACS framework was developed to specifically support Action Plan implementation, and has been integrated into the mandatory project reporting system, DGIF will use these resources to track the effectiveness of conservation actions in the Action Plan as outlined by Congress.

In addition to facilitating DGIF's prioritization and use of State Wildlife Grants and other resources, the Action Plan was also created to serve the broader conservation community and facilitate their actions. These efforts often occur without utilizing federal funds or involving DGIF which presents a vexing challenge. While efforts supported by DGIF can be tracked and evaluated using the resources described above, efforts implemented without DGIF involvement are not always reported or considered when the success of the Action Plan's implementation is being reviewed. This makes it more difficult to monitor the effectiveness of conservation actions and monitor resource changes over time.

Several issues hinder the effectiveness reporting on these non-DGIF projects. First, the issue of effectiveness was not comprehensively addressed within Virginia's original Action Plan. Many partners were not informed that effectiveness reporting was an important factor to consider nor were they provided with insights about the types of data that would be most useful to collect. Second, many partners face budget limitations and personnel shortages. Under such circumstances, voluntary project reporting is rarely considered a priority for the use of these limited human and financial resources. Staff considerations often limit the ability to track changes over time. As staff leave and positions are refilled, new staff members may not be aware of past projects and the need for collecting additional post-project data. Finally, DGIF has never provided the conservation community with a central repository where project and effectiveness data can be quickly and easily uploaded for review and reporting purposes.

DGIF addresses several of these issues within the updated Action Plan. In the language above, the authors describe the political situation regarding effectiveness measures and how critical effectiveness data are when dealing with policy and budget authorities. In the following section, the authors detail the importance of adapting conservation actions to both improve performance and address changing conditions. Virginia's Wildlife Action Plan Coordinator served on the teams that developed the Effectiveness Measures Report and the Wildlife TRACS system to help ensure these systems would be compatible with conservation efforts in Virginia. Based upon this work on effectiveness measures, tables

are included within each of the Local Summaries that identify the types of data that would be most useful to demonstrate the effectiveness of individual conservation projects.

DGIF staff also are exploring two opportunities that partners could use to upload project information for review and reporting purposes. First, the Wildlife TRACS development team has repeatedly discussed the need to provide partner organizations with a public access version they could use to promote projects implemented without federal funds. At the time of this writing, other higher priority portions of the Wildlife TRACS system are being developed and tested. This public version will be discussed when the core systems are functional. DGIF staff are also exploring opportunities to promote partner projects within the online version the 2015 Wildlife Action Plan, which will be developed and made available after the Action Plan's approval by the USFWS.

It is important to note that none of these efforts, however, are able to address how partners will prioritize project reporting and effectiveness measures. Additional outreach will be needed to ensure that the conservation community understands the importance of reporting and determine how reporting efforts can be encouraged and facilitated. Financial support may be required to inspire the collection of effectiveness data.

Adapting Conservation Strategies

As conservation projects are implemented and effectiveness data are collected, it is likely that projects will need to be modified, because experience will be gained, circumstances will change, or new information will become available. When fully operational, the Wildlife TRACS system will provide a mechanism to monitor effectiveness and identify issues. If issues or concerns are identified, DGIF and partners will use one of two mechanisms (updating species specific plans or working through DGIF's science teams) to adapt conservation efforts.

Plans or strategies have been developed for several specific SGCN conservation efforts. Examples of plans include the 2007 Virginia Quail Action Plan, the 2011 Canebrake Rattlesnake Conservation Plan, and the 2010 Virginia Freshwater Mussel Restoration Strategy: Upper Tennessee Basin (DGIF 2007; DGIF 2011; DGIF 2010). These plans are created in collaboration with appropriate partners and contributors. If it is determined that conservation actions are not meeting expectations, or if circumstances dictate that conservation objectives must be altered outside of the scope of the original plan, DGIF will coordinate efforts with partners and stakeholders to amend plans as necessary.

During the next decade, DGIF expects many conservation actions will be implemented using the Local Summaries as a guide. Few of these habitat and research efforts are expected to require a more specific or detailed planning document. As these projects are implemented, the Wildlife TRACS system (see above) is expected to provide the necessary effectiveness reporting framework to allow project managers and administrators to track and evaluate project results. Should a program need to be revised to address changing circumstances or new information, DGIF will rely upon its established science teams (see below) to provide program managers with the necessary guidance.

In 2010, DGIF changed its internal divisional structure. This altered structure enhances DGIF's opportunities to employ adaptive management principles. Prior to restructuring, wildlife conservation efforts had been divided among a Wildlife Division that focused on terrestrial game species and terrestrial and wetland habitats, a Fisheries Division that focused on sport fish and aquatic habitats, and a Wildlife Diversity Division that focused on threatened, endangered, and nongame species and their

habitats. During the restructure, these Divisions were merged into a new unit known as the Bureau of Wildlife Resources (Bureau). The Bureau relies upon a series of Science Teams to review, prioritize, and coordinate the implementation of conservation actions. With regards to the Action Plan and revising programs to address changing situations, the Terrestrial Wildlife and Habitat Science Team, the Aquatic Resources Science Team, the Upland Habitat Science Team, and the Conservation Planning Science Team will be responsible for working with program and land managers to review programmatic and project goals, evaluate performance, identify new goals and strategies to achieve those new goals, and describe how new/revised efforts will be evaluated. DGIF staff and administrators will coordinate with staff from the USFWS WSRP before implementing any changes to SWG-funded projects.

RESEARCH NEEDS

While updating the SGCN list (see Methods), partners were asked to describe actions that could be taken to conserve each species. Many partners identified research needs that fell into two categories. The vast majority of research needs involved collecting data to determine the distribution, status, and life history of SGCN. In most of these cases, no additional conservation actions were specified and species were classified as management opportunity “C”. In other cases, specific research needs were identified that must be addressed before “on the ground” actions can be implemented to benefit a species. Under these circumstances, species were classified in management opportunity category “B”. Absent other criteria, State Wildlife Grant dollars will be prioritized to address research needs for category “B” species. This is not to indicate that no baseline research will be implemented for category “C” species, but this type of research is expected to be a lower priority unless a compelling rationale can be articulated to explain how such an effort would likely lead to the removal of a species from the Action Plan or contribute to a restoration effort. A list of the category “B” species with specific research needs can be found in the Statewide Section.

During the implementation of this Action Plan, other research needs are likely to be identified as projects are developed and carried out. New research needs will be evaluated and prioritized during DGIF’s annual budgeting process. If the research involves a species that is not included within the Action Plan, DGIF staff will coordinate with staff from the WSRP to ensure compliance with USFWS guidelines.

STAKEHOLDER AND PUBLIC PARTICIPATION

Two of the Eight Essential Elements each Wildlife Action Plan must address involve outreach. Element 7 indicates that, “...Federal, State, and local agencies and Indian tribes that manage significant land and water resources within the State or administer programs that significantly affect the conservation of identified species and habitats...” must be afforded the opportunity to participate in the development, implementation, review, and revision of the Wildlife Action Plan (Public Law 106-291). In addition to the Federal, State, and local agencies and Indian Tribes, DGIF also worked to involve the many private nongovernmental organizations that own conservation lands and easements in Virginia or implement conservation projects consistent with the Wildlife Action Plan. Collectively, these groups are called conservation partners. Element 8 indicates that, “...broad public participation is an essential element of developing and implementing...” Wildlife Action Plans. Throughout the development of the Virginia’s 2015 Wildlife Action Plan, the authors have made a significant effort to engage and address the needs/interests of both the conservation partners and the general public.

Conservation partners were contacted in phases. The first group included partners that have been actively involved in implementing Virginia's 2005 Wildlife Action Plan. These meetings began in October of 2013 and continued through December 2014. These meetings were designed to inform partners that the Action Plan was being updated, describe the problems encountered while implementing the original Action Plan, discuss changes that would be made to address those problems, and to solicit feedback and cooperation. Table 2.1 lists the various agencies and groups that were contacted during this timeframe to set up a meeting via conference call or in-person (bolded are entities with which the co-authors met in-person or on the phone). The majority of these meetings lasted two hours. The Action Plan authors also met multiple times over the course of the Action Plan's development with many of these partners, including the Virginia Department of Conservation and Recreation's Natural Heritage Program, the Virginia Department of Forestry, and the Eastern Virginia Rivers National Wildlife Refuge Complex.

Table 2.1. First Phase Conservation Partners.

Federal	State	Regional/NGO
USFWS, Great Dismal Swamp National Wildlife Refuge	Va Dept. of Conservation and Recreation, Planning and Recreation Resources	North Atlantic Landscape Conservation Cooperative
NPS, Shenandoah National Park	Va Dept. of Conservation and Recreation, Natural Heritage Program	Southeast Atlantic Slope Mollusk Group
USFWS, Eastern Virginia Rivers National Wildlife Refuge Complex	Va Dept. of Forestry	Appalachian Landscape Conservation Cooperative
USFWS, Potomac River National Wildlife Refuge Complex	Va Dept. of Environmental Quality, Coastal Zone Management Program	South Atlantic Landscape Conservation Cooperative
USFWS, Ecological Services Staff		Appalachian Mountain Joint Venture
USFWS, Blackwater National Wildlife Refuge		TNC, Allegheny Highlands Program Coordinator
USFS, George Washington/Thomas Jefferson National Forests		TNC, Southern Rivers Program Director
USFWS, Back Bay National Wildlife Refuge		TNC, Clinch River Program Coordinator
USFWS, Chincoteague National Wildlife Refuge		TNC, Chesapeake Rivers Coordinator
USFWS, Wildlife and Sportfish Restoration Program, Region 5		TNC, Associate State Director for External Affairs and Senior Conservation Scientist
USFWS, Eastern Shore National Wildlife Refuge		
DoD, Marine Corps Base Quantico		
DoD, Natural Resources Program		
DoD, Naval Air Station Oceania		
DoD, Readiness and Environmental Protection Integration Program		
NRCS, Virginia State Office		

The second group of conservation partners contacted included three types of agencies or organizations. The first type included NGOs that expressed interest in being involved with the planning process. The second group included state natural resource agencies that had not chosen to participate in past efforts related to the Action Plan. The final group included local land use planning agencies. DGIF would like to partner more directly with the local land use planning agencies. Unfortunately, with over 100 cities and counties in Virginia, it was not feasible to meet with every member of this community. Instead, the authors contacted a subset of Virginia's Planning District Commissions representing urban and rural jurisdictions. Each of the following organizations was contacted and offered an opportunity to meet and

discuss this planning effort. Specifically, these meetings were designed to help participants understand the goals of the Action Plan and the information the plan would provide. The authors took these opportunities to better understand the other organizations' needs and how those could be accommodated within the updated Action Plan (Table 2.2). Bolded entities indicate a meeting was held, either in person or via phone call. The first of these meetings occurred in July 2014 and the last in December of 2014. The majority of these meetings lasted two hours.

Table 2.2. Second Phase of Conservation Partners.

State Agency	Organizations	Planning District Commissions
Virginia Marine Resources Commission	Xerces Society	Richmond Regional Planning District Commission
	Chesapeake Bay Conservancy	Hampton Roads Planning District Commission
	Virginia Institute of Marine Science	Northern Virginia Regional Commission
		Accomack/Norhampton Planning District Commission
		Northern Neck Planning District Commission
		George Washington Planning District Commission
		Middle Peninsula Planning District Commission
		Crater Planning District Commission

In October of 2014, the authors distributed a list of proposed species to be included as Species of Greatest Conservation Need within the update Action Plan. In addition to a wide range of DGIF staff, this list was distributed to conservation partners known to work directly with species and habitat conservation efforts. Recipients were provided with a set of guidelines explaining the draft prioritizations and instructions regarding how to recommend any changes to this list. Recipients were invited and encouraged to distribute this list to any other individuals or organizations they thought might be interested in participating in this effort. Table 2.3 lists all conservation partners that received the proposed SGCN list from the authors for review.

Table 2.3. Conservation Partners that Reviewed Proposed SGCN List.

Federal	State	NGO/ Other
USFWS, Eastern Virginia Rivers National Wildlife Refuge Complex	Virginia Dept. of Conservation and Recreation, Natural Heritage Program	Appalachian Mountain Joint Venture
USFWS, Potomac River National Wildlife Refuge Complex	Virginia Dept. of Forestry	Atlantic Coast Joint Venture
USFWS, Ecological Services Staff	Virginia Marine Resources Commissions	Virginia Audubon Society
USFS, George Washington/Thomas Jefferson National Forests	Virginia Institute of Marine Sciences	TNC, Chesapeake Rivers Program
USFWS, Eastern Shore National Wildlife Refuge		TNC Senior Conservation Scientist
USFWS, Chincoteague National Wildlife Refuge		TNC, Clinch River Program
USFWS, Back Bay National Wildlife Refuge		TNC, Allegheny Highlands Program
NRCS, Virginia State Office		TNC, Southern Rivers Program
NPS, Shenandoah National Park		Eastern Brook Trout Joint Venture
USFWS, Blackwater National Wildlife Refuge		Virginia Society of Ornithology
USFWS, Great Dismal Swamp National Wildlife Refuge		Xerces Society

On May 1, 2015, DGIF made the draft 2015 Wildlife Action Plan available to conservation partners and the public via the DGIF website at: <http://www.bewildvirginia.org/wildlife-action-plan/draft/> and <http://www.dgif.virginia.gov/>. To announce that these materials were available, the authors sent email notifications to the following agencies, conservation partners, and tribes (Table 2.4).

Table 2.4. Conservation Partners that Received the Draft 2015 Virginia Wildlife Action Plan for Review.

DCR, Natural Heritage Program	DCR, Planning and Recreational Resources	DOF
DEQ, Coastal Zone Management Program	DEQ, Division of Environmental Enhancement	Virginia Marine Resources Commission
Virginia Institute of Marine Science	Virginia Department of Transportation	Virginia Department of Agriculture and Consumer Services
USFWS, Virginia Field Office	USFWS, Southwest Virginia Field Office	USFWS, Chesapeake Bay Field Office
USFWS, Eastern Virginia Rivers National Wildlife Refuge Complex	USFWS, Back Bay National Wildlife Refuge	USFWS, Potomac River National Wildlife Refuge Complex
USFWS, Blackwater National Wildlife Refuge	USFWS, Great Dismal Swamp National Wildlife Refuge	USFWS, Chincoteague National Wildlife Refuge
USFWS, Eastern Shore National Wildlife Refuge	NRCS, Virginia State Office	DoD, Marine Corps Base Quantico
DoD, Naval Air Station Oceania	DoD, Readiness and Environmental Protection Integration Program	DoD, Natural Resources Program
US Geological Survey	Appalachian Mountain Joint Venture	USFS, George Washington and Thomas Jefferson National Forests
NPS, Shenandoah National Park	NPS, Appalachian National Scenic Trail	NPS, Appomattox Court House National Historic Park
NPS, Booker T. Washington National Monument	NPS, Colonial National Historical Park	NPS, Fort Monroe National Monument
NPS, Fredericksburg and Spotsylvania National Military Park	NPS, George Washington Birthplace National Historic Park	NPS, New River Gorge National River
NPS, Maggie L. Walker National Historic Site	NPS, Petersburg National Battlefield	NPS, Richmond National Battlefield Park
North Atlantic Landscape Conservation Cooperative	South Atlantic Landscape Conservation Cooperative	Appalachian Landscape Conservation Cooperative
Atlantic Coast Joint Venture	American Fisheries Society, Virginia Chapter	B.A.S.S. Federation Nation of Virginia, Inc.
Chesapeake Bay Foundation	Chesapeake Data LLC	Coastal Conservation Association
Ducks Unlimited	Eastern Brook Trout Joint Venture	Friends of Dyke Marsh
Virginia Society of Ornithology	Friends of the Rappahannock	Friends of the Rivers of Virginia
Garden Club of Virginia	Izaak Walton League	James River Association
National Wild Turkey Federation, Virginia	New River Land Trust	Northern Virginia Conservation Trust
Piedmont Environmental Council	Sierra Club - Virginia Chapter	The Wildlife Foundation of Virginia
TNC	Virginia Native Plant Society	Virginia Association of Counties
Virginia Audubon Council	Virginia Conservation Network	Virginia Council of Trout Unlimited
Virginia Deer Hunters Association, Inc.	Virginia Farm Bureau	Virginia Herpetological Society
Virginia Municipal League	Virginia Outdoors Foundation	Wetlands Watch
Wild Virginia	Wildlife Center of Virginia	XERCES Society
Virginia Master Naturalists	Accomack-Norhampton Planning District Commission	Central Shenandoah Planning District Commission
Commonwealth Regional Council	Crater Planning District Commission	Cumberland Plateau Planning District Commission
George Washington Regional Commission	Hampton Roads Planning District Commission	Lenowisco Planning District Commission
Middle Peninsula Planning District Commission	Mount Rogers Planning District Commission	New River Valley Planning District Commission
Northern Neck Planning District Commission	Northern Shenandoah Valley Regional Commission	Northern Virginia Regional Commission
Rappahannock-Rapidan Regional Commission	Region 2000 Local Government Council	Richmond Regional Planning District Commission
Roanoke Valley-Alleghany Regional Commission	Southside Planning District Commission	Thomas Jefferson Planning District Commission
West Piedmont Planning District Commission	Chesapeake Conservancy	The Wildlife Society, Virginia Chapter
Virginia Outdoor Writers Association	Absentee Shawnee Tribe of Oklahoma	Catawba Nation
Cherokee Nation of Oklahoma	Delaware Nation of Oklahoma	Delaware Tribe of Indians
Eastern Band of the Cherokee Indians	Eastern Shawnee Tribe of Oklahoma	Shawnee Tribe
Tuscarora Nation	United Keetoowah Band of Cherokee Indians in Oklahoma	

Following the release of the draft 2015 Action Plan for review, and the distribution of the announcement emails, recipients suggested that DGIF notify other potentially interested parties. These included Virginia's Environmental Educators, the Virginia Union of Land Trusts (VaULT), and the state recognized tribes. An announcement email was sent to the Environmental Educators on May 7. A comprehensive contact list for VaULT members could not be found until May 11. The authors spent several days trying to find appropriate contact information for the state recognized tribes, but were unsuccessful. On July 16, the authors were notified that the Pamunkey Tribe had become federally recognized and the USFWS was able to provide contact information for the tribal leadership. A letter was sent to the Pamunkey Tribe advising them of the Action Plan. This letter included an offer to meet to discuss the plan with tribal representatives.

In an attempt to distribute the Action Plan to a larger public audience, the authors worked with DGIF's outreach staff to post an announcement on DGIF's Facebook page. The Facebook posting resulted in 2466 Views, 116 Likes, and 25 Shares. DGIF considered issuing a press release to announce the Action Plan's availability. The DGIF's Media Manager indicated that Virginia's media outlets monitor Facebook, which has become a common method of distributing information to the media. However, to ensure media distribution, an announcement was sent directly to the membership of the Virginia Outdoor Writers Association. These efforts resulted in one interview with a reporter from the Winchester Star newspaper. During a discussion with DGIF's Media Manager, the authors expressed disappointment with the limited response. The authors were informed this level of response was consistent with the level of response received on posts regarding similar topics.

In another attempt to distribute the Action Plan to a larger public audience, the authors worked to give presentations to a variety of groups regarding the purpose of the Action Plan. The authors requested DGIF staff and other partners help identify opportunities to give presentations to conservation partners and public audiences. Between October 2013 and August 2015, the authors were invited to give presentations to the Garden Club of Virginia, the Roanoke Valley Bird Club, the Roanoke Izaak Walton League, the Adult Forum Program for St. George's Episcopal Church in Fredericksburg, Virginia, and the Chesapeake Bay Foundation's Richmond Supper Club. These presentations all involved discussions of the Wildlife Action Plan which included describing how climate change would be addressed, how the updated Action Plan would be formatted, types of threats to wildlife and habitats that would be included, and types of actions that can be taken to address these issues. Each of these meetings was open to the public and audiences ranged in size from 20 individuals to 120 individuals. During each presentation, the presenter offered to meet with other groups at other events as needed.

Additional presentations were given to the joint annual meeting of the Virginia/West Virginia Chapters of the American Fisheries Society (approximately 150 participants), the Crater Planning District Commission's Quarterly Planning Director's Meeting (8 participants), the joint meeting of the Northern Neck Planning District Commission, the Northern Neck-Chesapeake Bay Region Partnership, and the Northern Neck Tourism Commission (40 participants), and the Commonwealth Planning Region's monthly County Administrator's meeting (____ participants).

The Action Plan's authors submitted an article for the Virginia Master Naturalists newsletter, *The Pollinator*. The article was distributed in July 2015, and the newsletter has an estimated total circulation of 1800 households. The article focused on the history of the Action Plan, its updated format, threats, conservation actions, and opportunities for Master Naturalist chapters to become involved with Action Plan implementation. The Action Plan authors were also contacted by the Green Infrastructure Center to

collaborate on a training curriculum to help local land use planners incorporate the updated Action Plan with local land use plans and green infrastructure plans.

The updated Wildlife Action Plan was presented to the Virginia Board of Game and Inland Fisheries on August 20, 2015. This meeting was open to the public, and the public was provided an opportunity to comment on the draft Action Plan during this event.

DGIF Involvement

When Virginia's original Action Plan was written, the planning effort was directed by the Wildlife Diversity Division. The Wildlife Diversity Division consisted of programs related to threatened and endangered species, nongame species conservation, environmental commenting, watchable wildlife, geospatial analysis, and data management. During 2010, DGIF executed a significant restructuring of its wildlife resource programs. Per this restructure, the former Wildlife Diversity Division was merged with the former Fisheries Division, which managed sportfish resources, and the former Wildlife Division, which managed terrestrial game species and habitat resources. These three divisions, Wildlife Diversity, Fisheries, and Terrestrial Wildlife, became the Bureau of Wildlife Resources. Functions and procedures within the Bureau are distinctly different from those used during the previous agency structure. These changes are significant in terms of how DGIF prioritizes projects and allocates State Wildlife Grant dollars.

In updating the Action Plan, to develop an effective and comprehensive document, it was imperative to ensure that the diversity of Bureau programs and personnel had the opportunity to participate in this planning effort. DGIF staff members are an important conservation partner and, as such, were treated as a target for outreach efforts consistent with the guidance of Element 7.

Between October 2013 and March 2014, the Action Plan authors met with the Bureau's Administrative Team, the Bureau's Threatened and Endangered Species Committee, the terrestrial biologists and administrators from each of DGIF's four management regions, the aquatic biologists and administrators from each of DGIF's four management regions, and DGIF's Media Manager. These meetings were scheduled to announce the update of the Action Plan, describe issues encountered with the original Action Plan, the process that would be used to create the updated plan, and to notify staff of the opportunities they would have to participate in the update process.

Between April 2014 and June 2014, the Action Plan authors coordinated meetings with DGIF staff to discuss habitat concerns. Specifically, meetings were held to discuss how habitats should be identified and classified within the updated Action Plan, what issues threatened the viability of those habitats, and what actions could be taken to address those threats. Meetings were held to discuss coastal/marine habitats, wetland habitats, forest habitats in eastern Virginia, forest habitats in western Virginia, karst habitats, open habitats (including grassland, shrub land, post-agricultural, glade, and savanna habitats), and aquatic habitats in DGIF's four management regions. Each of these meetings required two to five hours. At several times during this process, the Action Plan authors met with the Bureau's senior administrators to update them on the planning process and issues that needed to be addressed. Meetings with DGIF staff and administrators were extraordinarily helpful in that they helped the authors develop the first draft of narratives and materials that facilitated discussions with Conservation Partners and the writing of the final Action Plan.

On April 14, 2015, two weeks before the draft Action Plan was made available to the general public, the draft Action Plan was made available to Bureau staff for review and comment. This provided an additional opportunity to find typographical errors, identify issues with species distributions, and clarify narratives regarding habitats, conservation threats, and actions.

Summary of Comments and Action Plan Adaptations

Thirteen members of DGIF staff and fourteen outside individuals and organizations provided comments on the draft Action Plan. Generally, comments were positive and complimentary of the new format. For example:

“On the whole this is an excellent plan that shows a lot of thoughtful “big picture” consideration of ecosystem conservation. I applaud the shift from a focus on single species to a concern for habitat conservation. I especially applaud the recognition of climate change and its implications for wildlife. In today’s political climate, this is a courageous step.”

“It's very well researched, comprehensive, and informative.”

“The plan overall looks great I think. You have digested what you and others saw as challenges (to implementation) in the last WAP, and worked very hard to materialize those into improvements in this plan. “

Other categories of comments Included:

- The most common comments involved typographical mistakes, which were corrected.
- Some reviewers notified DGIF of changes made to either the common name or scientific name for some species. These comments were reviewed and corrected as directed. Such changes were forwarded to the biologists that maintain the Virginia Fish and Wildlife Information System.
- Several reviewers identified species distribution errors within the Local Summaries. Each of these comments was reviewed and Local Summaries were corrected as needed.
- Some reviewers expressed concerns regarding the prioritization of specific species. If sufficient information was provided (see section on updating the SGCN list) changes were made. If insufficient data was provided, reviewers were contacted to request additional information.
- Several reviewers provided additional details about conservation properties identified within the Local Action Plan Summaries. Properties were added or removed from these lists as directed.
- Several DGIF staff requested language be added to identify white-tailed deer as a threat impacting forest habitats in specific planning regions. Working with the appropriate district biologist and one of DGIF’s Deer Program Managers, text was drafted and included as

needed to indicate the impacts deer have on forest habitats and the conservation actions that can be taken to address these issues.

- Several reviewers correctly identified that the draft Action Plan failed to discuss the issue of habitat connectivity for either aquatic or terrestrial habitats. This was an unfortunate oversight which the authors are working to correct. Information on aquatic connectivity has been added to the Statewide Section and the appropriate planning region chapters. At this time, no prioritization tool exists for Virginia's rivers that flow into the Mississippi River drainage. These data will be incorporated into the online version of the Action Plan as they become available. Regarding the connectivity of terrestrial habitats, at the time of this writing, DGIF is collaborating with the North Atlantic Landscape Conservation Cooperative to identify Regional Conservation Opportunity Areas for the 13 northeastern states. Connectivity is a key factor being considered in this effort and these data will be incorporated into the online version of the Action Plan as they become available.
- One reviewer correctly identified a flaw in the process used to identify priority watersheds within each of the local planning regions. The draft Action Plan only identified watersheds as priorities for restoration. No information was provided to identify healthy watersheds that would be conservation priorities in their current state. To address this issue, the authors met with representatives from the Virginia Natural Heritage program to discuss the Virginia Healthy Waters Initiative. Following this meeting, the Statewide Section and each of the planning region chapters were updated to include narrative and maps from the Virginia Healthy Waters Initiative. New materials will be added to the online version of the Action Plan as the Virginia Healthy Waters Initiative is updated in 2015 and 2016.
- Planners from the Central Shenandoah Planning Region contacted DGIF to discuss a particularly troublesome habitat threat near the town of Elkton, Virginia. After discussing and conferring with the town planner, this project was added to the Local Summary as a priority project.
- The updated Action Plan prioritizes species both by their level of imperilment and conservation opportunity. Each SGCN is assigned to one of three conservation opportunity scores: A, B, or C. Category B identifies species that either have specific research needs or "on the ground" conservation actions have been identified that cannot currently be implemented due to a lack of funding, personnel, or other resources. One reviewer suggested that category B was too broad and could be misleading to readers. They suggested adapting the conservation opportunity rankings so that category B would be broken into more descriptive subcategories. The authors understand this concern and also recognize that the conservation opportunity ranks will need to change over time as this Action Plan is implemented. Rather than complicate an untested system, the list of SGCN provided within this Action Plan (see Appendix A) has been expanded to include a notes section to indicate why each conservation opportunity ranking was assigned to each SGCN. Modifications to the conservation opportunity categories will be considered when the Action Plan is updated.

In summary, those individuals that commented on the draft Action Plan provided significant feedback and insights that have helped improve the quality and utility of the document. As the updated Action

Plan is implemented, DGIF staff and others will continue collaborating with Conservation Partners and working to inform the general public about the wildlife conservation efforts implemented on their behalf.

UPDATE OF VIRGINIA'S WILDLIFE ACTION PLAN

Congress requires that each state describe the procedures that will be used to review and update their Action Plan at intervals not to exceed ten years (Public Law 106-291). Virginia will complete a comprehensive and formal revision of Virginia's Wildlife Action Plan by October 2025. The exact process for updating this Plan will be determined closer to that deadline. The process will, however, be developed in close consultation with DGIF administrators, DGIF staff, the USFWS, other agencies, and partners. As indicated previously, DGIF will continue its annual reporting of projects and accomplishments. When reporting on projects funded via State Wildlife Grants, DGIF will provide data on project outputs and effectiveness measures per the standardized metrics developed by AFWA and the Wildlife TRACS system. If indicated by the effectiveness and project output data, projects and programs may be altered to better address changing conditions. Efforts may also be adjusted as new technologies, data, or conservation strategies become available. If circumstances require the Action Plan be revised prior to the 10-year deadline, DGIF staff will coordinate efforts with the appropriate representatives of the USFWS' WSFR Program.

3. STATEWIDE OVERVIEW

SPECIES SUMMARY

Virginia's 2015 Action Plan includes a list of 884 SGCN. DGIF and partners recommended that 89 of the species included in the 2005 Plan be removed from the SGCN list. In most of these cases, species were found to be more abundant than previously thought based on information gathered after the original Action Plan was published. Unfortunately, of these species, the green blossom pearly mussel is believed to have gone extinct since the Action Plan's publication and the Appalachian Bewick's wren is no longer found in Virginia.

Partners recommended adding 48 new species to the revised Action Plan SGCN list for a variety of reasons. Seven new bats were included to reflect the impacts of white-nose syndrome, a disease which did not exist in 2005. Species such as the common snapping turtle and marine mammals are being included to highlight actual and potential population declines due to human use and habitat development concerns. Seven bumble bees and the monarch butterfly have also been added in recognition of international declines in these pollinator populations.

DGIF biologists and partners also reviewed the remaining SGCN from the 2005 Action Plan and determined they should remain within the 2015 Wildlife Action Plan. Two dozen of these species were assigned a new Tier rank to indicate changes in their condition or circumstances. Additionally, the American Fisheries Society updated the taxonomy for several species of fish, mollusks, and crustaceans. As such, a handful of species may appear to be new additions to the Action Plan while they are, in fact, species that were formerly included under different names. The number of species within each taxonomic group and tier are identified within Table 3.1.

Table 3.1. Number of SGCN per Taxonomic Group by Tier.

Taxonomic Group	TIER I	TIER II	TIER III	TIER IV	TOTAL
Amphibians	5	8	8	11	32
Reptiles	8	4	7	14	33
Fishes	18	8	19	50	95
Birds	14	13	18	35	80
Mammals	11	5	3	14	33
Aquatic mollusks	29	17	17	25	88
Aquatic crustaceans	9	26	14	4	53
Aquatic insects	5	24	39	80	148
Other aquatic invertebrates	5	4	1	2	12
Terrestrial insects	10	35	25	57	127
Other terrestrial invertebrates	7	70	35	71	183
Total	121	214	186	363	884

In addition to updating the Tier rankings to describe level of imperilment, each species was assigned a Conservation Opportunity Rank of A, B, or C (see Methods and Approach Section). This new prioritization scheme helps managers focus attention on species with specific management needs and

opportunities. Of the 884 SGCN identified within the 2015 Action Plan, 23.4 percent are classified as Category A, indicating that managers have identified on the ground strategies to manage either the species or its habitat. Another 7.1 percent of the 2015 list of SGCN are classified as Category B, indicating either specific research is needed to facilitate on the ground action or on the ground opportunities cannot be implemented at this time due to a lack of resources. The remaining SGCN (69.5 percent) are classified as Category C, indicating managers have not identified on the ground strategies or specific research needs that will facilitate on the ground action. Species also were assigned to Category C when available conservation opportunities have been exhausted. It should be noted that baseline life history and distribution data are lacking for many of the SGCN. Given the broad nature of this research need and the difficulty of evolving such efforts into an on the ground management strategy, these species were classified as Category C.

The Tier and Conservation Opportunity Rankings are provided for SGCN within Appendix A. Appendix A also provides a brief explanation regarding why each species was assigned to a tier and conservation opportunity category. The SGCN that occur within each planning region are identified within the Local Action Plan Summaries.

Species Status

The USFWS and DGIF track the status of many species with regards to the federal and state Endangered Species Acts. Species may be designated as being threatened or endangered at the state and/ or federal level. Species may also be designated as being “proposed” for protection, a “candidate” species, a “species of concern”, or a species of “collection concern.” An individual can be assigned to a single category or multiple categories. Virginia’s Fish and Wildlife Information Service indicates which species have been assigned to each of these categories. Of the 884 Action Plan species, 220 (24.7 percent) have been assigned to one or more of these additional categories (Table 3.2).

Table 3.2. Species with State and Federal Threatened or Endangered Status.

# of Species	Classification	DGIF Coding
58	Federal Endangered/State Endangered	FE/SE
10	Federal Threatened/State Threatened	FT/ST
1	Federal Threatened/State Endangered	FT/SE
12	Federal Species of Concern/State Endangered	FS/SE
9	Federal Species of Concern/State Threatened	FS/ST
22	State Endangered	SE
24	State Threatened	ST

HABITAT SUMMARY: DESCRIPTIONS, STATUS, THREATS, AND CONSERVATION ACTIONS

Virginia boasts a broad diversity of habitats from beaches, dunes, and mudflats in the east to spruce-fir forests in the west. While it is convenient to think of habitats as isolated and self-contained communities, they are in fact interconnected and interdependent. Healthy upland habitats contribute to the quality of riparian and aquatic habitats. Likewise, the condition and quality of upstream habitats influences the health of downstream and marine habitats. The key factor linking these habitats together is water. Given the importance of water to terrestrial and aquatic habitats, conservation actions in this

section and in the Local Summaries have a significant focus on water quality and maintaining that quality through habitat management and habitat restoration. Thus, actions in this Plan encompass a broad range of targets and provide opportunities for a diversity of partners. Other habitat specific actions are also important and included within the Action Plan, but water quality issues can be found across all habitat types.

A number of models have been developed to identify habitat types and describe their condition. Some models, such as the ecoregional descriptions produced by the USEPA describe areas of discrete biotic and abiotic conditions across large regional areas (Griffeth et al. 1999). The Natural Communities of Virginia: Classification of Ecological Community Groups is based on assemblages of co-existing, interacting species that are considered together with the physical environmental and associated ecological processes (Fleming et al. 2013). The National Land Cover Dataset (NLCD) has a finer spatial resolution than ecoregions and describes the landscape using over 20 different coarse land cover classes (Fry et al. 2011). The Nature Conservancy through the Northeast Terrestrial Habitat Map (NEHTM) and others have developed habitat models at a fine spatial resolution, using narrowly defined land cover classes (Anderson et al. 2013). However, the NETHM (as well as other spatial data sets such as NLCD, LANDFIRE, etc.) is primarily useful as a coarse-scale spatial planning tool, and it should not be relied upon, or at a minimum needs adaptation to be used, at finer scales (e.g., local level) for planning specific restoration and management actions. The NETHM lacks a comprehensive accuracy assessment and has been shown to inaccurately classify a number of reference sites into developed classes (Simon, personal communication). However, Virginia DGIF conducted an accuracy assessment for the NETHM within Virginia. Results demonstrated that at the ecosystem level, accuracy is approximately 50 percent, while accuracy improves to almost 80 percent when considering macrogroups or other similar habitat types (Klopfer and McGuckin 2014). This is understandable given its use of Forest Inventory Assessment (FIA) data which are underrepresented at finer spatial scales and for less common systems/habitats. Finer resolution mapping products have been developed by partners (e.g., ecological zones) and should be evaluated for local planning purposes (especially in the western and southwestern portions of the state).

This Action Plan borrows from these conservation models and tools and adapts their habitat data to best suit the needs of land and water managers. The Action Plan provides a crosswalk between the habitat definitions from the NETHM classification system to ensure this Action Plan is useful to all conservation practitioners as well as to demonstrate how the model classification can be used by land managers. Eight basic habitat types are described and referenced within this Action Plan. Within these habitat types, several other habitat subcategories are described. Habitats in this Action Plan include:

- Beaches, Dunes, and Mudflats
- Tidal wetlands
- Non-tidal wetlands
- Freshwater aquatic and riparian habitats
 - Tidally influenced warm water streams and rivers
 - Coldwater streams and rivers
 - Non-tidal warm water streams and rivers
 - Blackwater streams and rivers
- Open habitats
 - Post-agricultural lands
 - Glades and barrens
 - Pine and oak savanna

- Mixed hardwood/ conifer forests
 - Young forests
 - North Atlantic coastal plain maritime forest
 - Central Atlantic coastal plain maritime forest
 - Southern Atlantic coastal plain upland longleaf pine woodland
 - Southern Appalachian low elevation pine forest
- Spruce fir forests
- Karst and subterranean habitats

These habitat types were identified based on the meetings with DGIF staff and conservation partners (see Methods Section). Information about these habitats, threats that affect habitat quality, and actions that can be taken to address these threats at a statewide level are described below.

Beach, Dune, and Mud Flat Habitats

Beaches, dunes, and mudflats are found along Virginia's coasts and barrier islands. Beach and dune vegetation is limited in distribution by the interaction between winds, changing sands, and wave action and also by the need to be salt-tolerant. Trees and shrubs, for example, are restricted to growing only in sheltered areas (Anderson et al. 2013). Moisture is maintained through salt spray and rain events. Virginia has over 3,300 miles of coast along the Atlantic Ocean and the Chesapeake Bay (DEQ 2014). Beaches and dunes are found in all four of the coastal planning regions adjacent to the Chesapeake or the Atlantic, but these habitats are relatively rare.

Much of Virginia's Atlantic beach and dune habitats on the Eastern Shore have been conserved by a combination of state, federal, and private entities. This area is known as the Virginia Coast Reserve. South of the Chesapeake Bay, along the Atlantic Coast of mainland Virginia, areas of beach and dune habitats are conserved within Back Bay National Wildlife Refuge and First Landing State Park. With a large amount of beach habitat under conservation, business and industrial development is not a significant threat for this area of Atlantic beaches and dunes. Sea-level rise and land subsidence, however, are considered to be a threat. Several climate models indicate ocean levels could rise by three feet or more by 2100, potentially leaving hundreds of acres of Virginia's shorelines vulnerable to inundation (VIMS 2013).

Residential development is a concern on the Bayside of the Eastern Shore and other portions of Virginia's coastline. Building homes, roads, and other structures, combined with increasing levels of human activity, can impact beach nesting species and diminish the quality of these coastal habitats.

Partners also expressed concerns related to landowner and community efforts to protect developed areas from wind and wave activity. Coastal areas are dynamic with beaches and dunes shifting and migrating as they are influenced by wind, waves, and other factors. These shifting shorelines can threaten homes and other structures. Shoreline hardening, or the use of solid bulkheads or boulders to disrupt the natural movement of shorelines, is a relatively quick and economical way to protect these developed areas (NRC 2007; Kane 2011). Unfortunately, hardened shorelines limit wildlife use and access and, as sea levels rise, prevent beach migration, often resulting in beach habitats being submerged and lost. Invasive species, such as beach vitex (*Vitex rotundifolia*), are also problematic for beaches and dunes as they can alter the shifting nature of dunes, cover beaches, and often eliminate native plants that are beneficial to wildlife.

There are three primary actions that will help conserve the quality and longevity of Virginia's beach and dune habitats. The first includes working with communities to manage human activities on beaches and dunes at specific times when wildlife, such as beach nesting birds and sea turtles, are most vulnerable to disturbance. This management action may not need to result in permanent human exclusion.

As noted earlier, beaches and dunes are active and dynamic habitats that move in response to wind and wave activity. If prevented from moving, these relatively rare habitats can be submerged or overgrown and converted into other, more common, habitats that do not support the unique set of beach and dune-dependent species. Preventing development and refraining from shoreline hardening in areas inland and adjacent to existing beach and dune systems would help ensure the long-term persistence of these systems as sea levels continue to rise and lands continue to subside.

The third action includes focusing on invasive species and predator control. Virginia's beaches, dunes, and mudflats are recognized as internationally important areas for migrating birds and other species (TNC 2015). The degradation of these habitats by invasive plants, or the disruption of nesting by predation, can have profound impacts on wildlife populations. It is important that conservation partners work to eradicate invasive plants as they are detected, prevent the introduction of new invasive species, and limit avian and mammalian predators as needed to support beach and dune nesting species.

Wetland Habitats

The term "wetlands" refers to a complex combination of habitats. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and human disturbance. USEPA regulations define wetlands as, "...those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated conditions (40 CFR 230.3(t))." Wetlands are frequently classified by the types of vegetation they support: emergent, shrub/scrub, and forested.

Across Virginia, there are approximately one million acres of tidal and non-tidal wetlands (DEQ 2014). Tidal wetlands are made up of both salt and brackish marshes that are dominated by grasses, forbs, and sometimes shrubs, and they are found along Virginia's coastal areas (Comer 2003). They also include tidally influenced swamps. Approximately 236,000 acres of tidal wetlands remain in Virginia (DEQ 2014). Tidal marshes are found in all eight coastal planning regions. Depending upon the planning region, they may occupy as little as 0.1 percent to approximately 8.0 percent of the land area.

The second wetland type within Virginia is freshwater, non-tidally influenced wetland. These freshwater, nontidal wetlands include a diversity of emergent, shrub/shrub, and forested wetland and swamps (Anderson et al. 2013). Freshwater systems are dynamic habitats which, as they age, can change from emergent to shrub, or forested forms. Freshwater wetlands can also include spring seeps in the mountains, sink hole ponds, vernal ponds, and other forest wetland communities. Approximately, 808,000 acres of non-tidal wetlands remain in Virginia (DEQ 2014). Non-tidal wetlands are found across all of Virginia and all planning regions. However, they often constitute a small portion of the total land cover within any given planning region.

Virginia has lost approximately 40 percent of all its precolonial wetlands (DEQ 2014). Of Virginia's remaining wetlands, 72 percent are in the Coastal Plain, 20 percent in the Piedmont, and 9 percent in the rest of the state (DEQ 2014). Wetland habitat quality is severely stressed in the Hampton Roads area and moderately to severely stressed around Richmond, Fredericksburg, and Northern Virginia (CZM 2011). Additionally, wetland water quality is also moderately to severely stressed in those same areas as well as much of southeastern coastal Virginia and the Eastern Shore (CZM 2011). Anderson et al. (2013) project a range of approximately 45 to 750 acres of Virginia's freshwater wetlands will be lost per year over the next 50 years.

In addition to their habitat value, wetlands provide many valuable ecosystem services to human communities. Wetlands help prevent nutrients and other harmful materials from flowing into streams, they can protect inland areas from floods and storm surges, and they provide recreational opportunities for hunters, anglers, and wildlife watchers. Four issues represent the greatest threats to Virginia's wetland habitats:

- Degradation of water quality,
- Land conversion/ land use changes,
- Invasive species, and
- Sea-level rise/ inundation.

As discussed previously, the updated Wildlife Action Plan utilizes the Virginia Wetlands Catalog to identify healthy and intact watersheds that are priorities for conservation. Designation of wetland conservation priority areas was based on several factors, including existing plant and animal diversity, presence of significant natural communities, presence of natural lands providing ecosystem services, presence of corridors and stream buffers, proximity to conserved lands, inclusion within or downstream of healthy watersheds, and location of drinking water sources (Figure 3.1) (Weber and Bulluck 2014). DCR also identifies degraded wetlands and prioritizes these areas based upon their restoration potential. The restoration wetlands were identified based on similar factors as conservation areas, but also including consideration of inclusion within degraded watersheds, proximity to impaired waters, location of existing wetland mitigation banks, presence of prior converted and farmed wetlands, and inclusion of stream reaches with lower aquatic biodiversity (Figure 3.2) (Weber and Bulluck 2014). Priority areas for conservation and restoration to address the threats described below are highlighted in each Local Summary using the rankings provided by the Virginia Wetlands Catalog. Maps of priority wetlands for conservation and restoration are provided within each Local Summary.

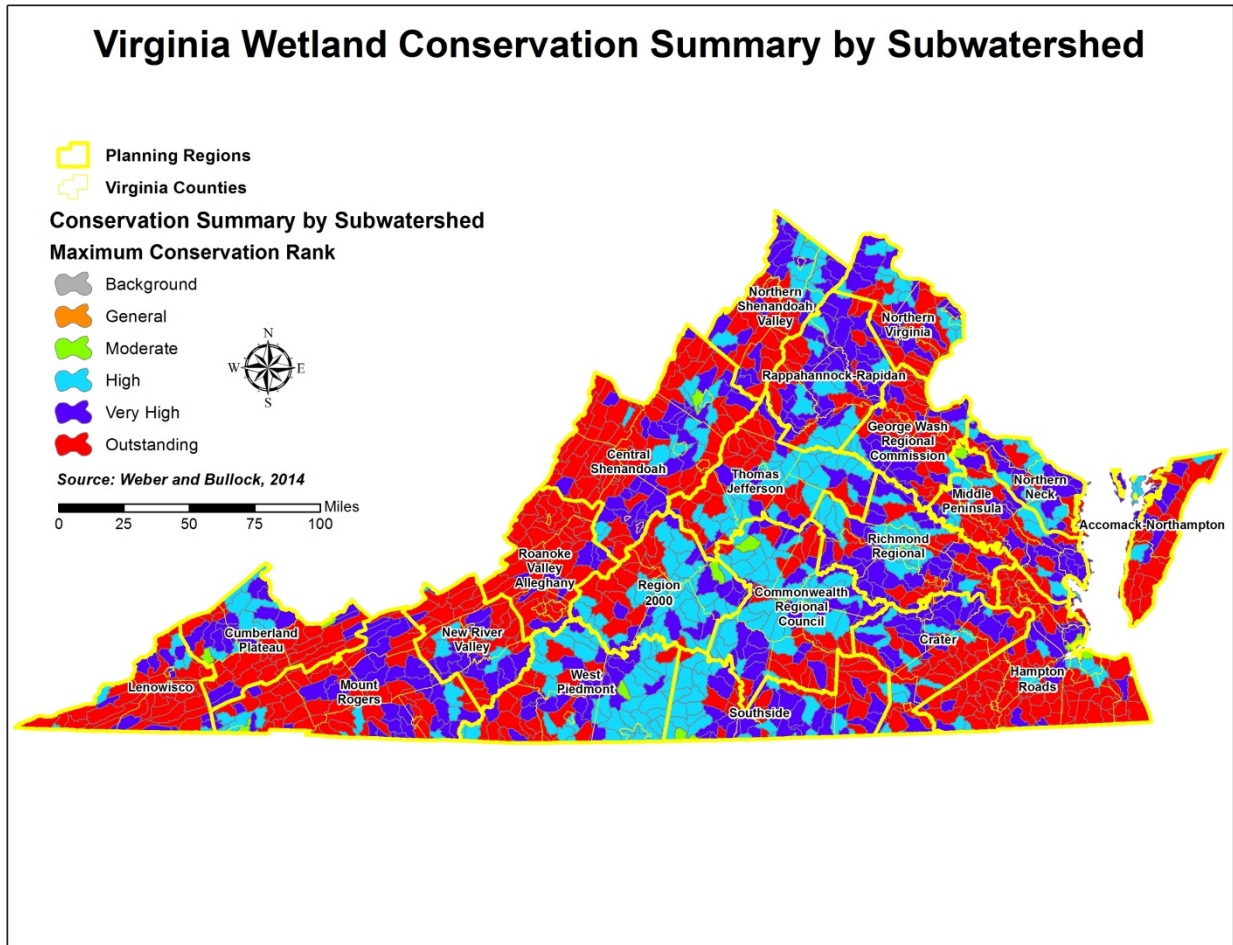


Figure 3.1. HUC12 Watersheds Containing Priority Wetlands for Conservation (Weber and Bulluck 2014).

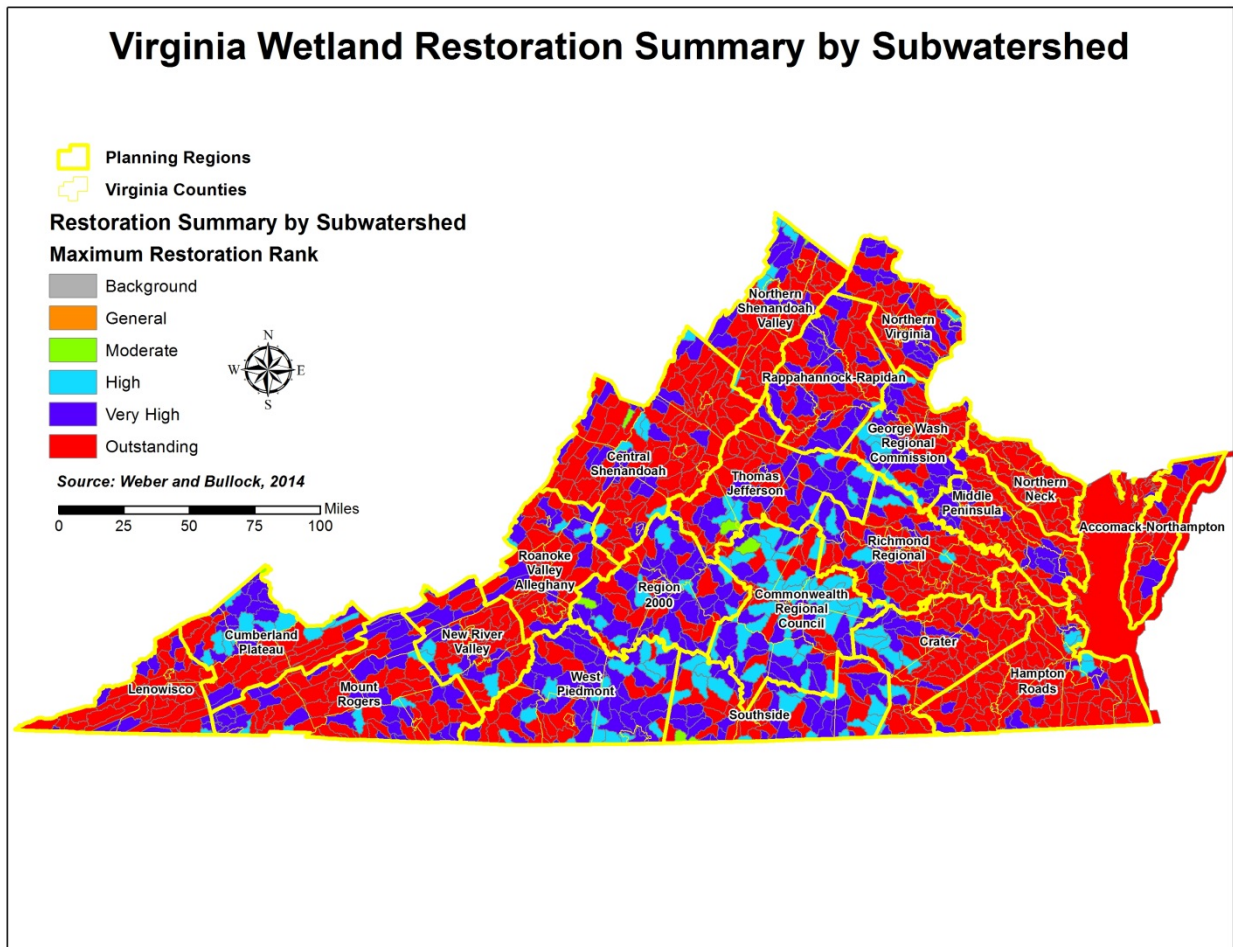


Figure 3.2. HUC12 Watersheds Containing Priority Wetlands for Restoration (Weber and Bullock 2014).

Wetlands and Water Quality

Wetlands help filter nutrients and other pollutants from watersheds, but they are also sensitive to activities that impair water quality and overload the system (Hemond and Benoit 1986). When best management practices (BMP) are not implemented upstream, runoff laden with nutrients, sediment, and other pollutants enter the system in concentrations that hinder the wetland's filtering capacity. Storm water runoff from urban and developed areas also contributes to water quality issues that degrade wetlands (Hemond and Benoit 1986). Nutrient pollution and sedimentation are important issues for tidal and non-tidal wetlands throughout the Commonwealth. The most significant threats to water quality involve sediment, nutrients, chemical pollutants, and fecal matter flowing from the riparian areas and upland habitats into streams, and rivers. Efforts to address water quality issues will also benefit efforts to conserve and restore Virginia's wetland habitats.

Wetlands and Land Conversion/ Land Use Changes

Although Virginia has a no net loss policy that applies to development projects and a permitting process established under the Virginia Water Protection Permit Program, all wetland types can be converted, either intentionally or accidentally, to other land uses. Many non-tidal wetlands are filled and converted to upland habitats that can be used for lawns, agriculture, commercial development, or other purposes.

In other cases, the construction of impoundments inundates non-tidal wetlands and result in open water habitats (DEQ 2011). While wetland conversion conducted under a permit often require some form of wetland restoration, enhancement, or mitigation to offset the habitat loss, many small wetlands, which are difficult to map and track, can be quickly and easily inundated or converted with little risk of regulatory action (DGIF personal communication 2014).

The most significant and extensive threat to tidal wetlands involves the filling of wetlands to make areas suitable for residential and other types of development (CZM 2011; DEQ 2011). Sea-level rise and invasive species are also significant threats (CZM 2011). Hydrologic alteration (ditching, channelization, diversions, etc.), which prevents water from getting to the wetlands, and erosion, which fills wetlands, are moderate threats but extensive throughout the region (CZM 2011; DEQ 2011). Pollution is also a problem in much of the state (CZM 2011). Additionally, tracking of the no net loss policy and implemented mitigation is not as well established for tidal wetlands as it is for non-tidal wetlands (CZM 2011).

To address development and fill impacts, the federal government and the Commonwealth of Virginia have established an extensive wetlands permitting process to help landowners and developers avoid impacts to wetlands while pursuing their management objectives. The Virginia Tidal Wetlands Act gives authority to the Virginia Marine Resource Commission (VMRC) to issue tidal wetland permits with the option for local governments to assume this responsibility (DEQ 2011). The U.S. Army Corps of Engineers has authority to issue permits for impacts to non-tidal wetlands through the federal Clean Water Act, while DEQ has that authority under Virginia's State Water Control Law. Permits are issued through a Joint Permit Application Process that can be initiated with DEQ or VMRC (DEQ 2011). Mitigation to compensate for wetland loss is often required under these permits. However, wetlands restoration to reestablish or rebuild former wetland areas or restore functions to a degraded wetland also are voluntary conservation actions agencies and conservation partners can implement outside of required wetlands mitigation (DEQ 2011). These types of conservation actions also help provide migration corridors for migratory birds that depend on wetlands for nesting, roosting, and foraging.

In certain situations, living shorelines can be a viable alternative to hardened or armored shorelines that can negatively affect wetlands. By using native vegetation, oyster reefs, dune restoration, rock sills, bank grading, or other more natural methods, living shorelines can help protect private property from erosion while also protecting wetland habitats (Kane 2011; VIMS 2010). Establishing or protecting vegetative buffers upland and upstream of wetlands is important to protect the health of existing wetlands as well as to provide a potential migration route as conditions change (Kane 2011). Although a proportion of tidal and non-tidal wetlands in many planning regions are protected in National Wildlife Refuges and other protected areas, the protection of additional wetland areas through acquisition, easement, or agreement would allow for further conservation of this important habitat and associated SGCN.

Wetlands and Invasive Species

Scores of invasive species have been introduced into Virginia. These invasive plants and animals often degrade the quality of wetland habitat through damage or loss to wetland vegetation. *Phragmites* is the most damaging invasive plant impacting Virginia's tidal wetlands. This species can out-compete native vegetation, creating a wetland monoculture with diminished function and habitat value. Purple loosestrife and Japanese stilt grass are also widespread in Virginia and degrade the quality of Virginia's freshwater wetlands. Faunal threats include mute swans, nutria, and feral hogs. Once populations of

these species become established, they become incredibly difficult and expensive to eradicate (VISWG 2012).

Multiple state and federal agencies work to address invasive species issues within Virginia. Despite this effort, there are insufficient human and financial resources in Virginia to completely eradicate all invasive species. In order to facilitate and enhance the Commonwealth's ability to address invasive species, the Virginia Invasive Species Working Group completed the Virginia Invasive Species Management Plan (VISWG 2012). This document identifies seven goals (each with multiple strategies) for addressing invasive species issues in Virginia, many of which relate to wetlands (See Invasive Species section for more information below).

Wetlands and Sea Level Rise / Inundation

As sea levels rise, wetlands may be inundated and convert to shallow open water habitats. Likewise, non-tidal and brackish wetlands may convert to higher salinity marshes. Shallow open water habitats and salt marshes will not support the same vegetative composition as the existing non-tidal and tidal wetlands, affecting the wildlife species that depend on these habitats (CCSP 2009). As botanical communities are degraded by changing conditions, they may become more susceptible to invasive species. Additionally, as storms become more intense, more frequent storm surges and inundation may also pose problems for vegetation and fish and wildlife species with low salinity tolerances (CCSP 2009).

Climate-related wetlands conservation actions include: restoring and enhancing vegetation within the wetlands to support changing conditions (e.g., using vegetation species that can withstand a broader array of conditions like more frequent inundation and higher salinity levels), restoration of wetlands to increase their elevation along the coast where feasible or needed, and enhancement of wetland migration by targeted restoration or acquisition in areas where wetlands may migrate (both inland and upstream).

Freshwater Aquatic and Riparian Habitats

Rivers and streams can be described using a variety of different factors such as flow, temperature, slope, water chemistry, and substrate. In discussions with conservation partners, four important freshwater habitat types were identified: *tidally influenced, non-tidally influenced warm water, cold water, and blackwater*.

Tidally influenced rivers experience some degree of tidal action. Salinity levels can vary greatly in tidally influenced waters (0.5 parts per thousand (ppt) to 35 ppt in the open ocean) and depend upon location within an estuary, the tides, and volume of freshwater inputs (VIMS website 2015). Tidal rivers and streams are typically associated with mudflats, swamps, and brackish and salt water wetlands (Anderson et al. 2013). Tidally influenced rivers occur east of the fall line in all eight coastal planning regions.

Blackwater streams and rivers are acidic, slow moving streams characterized by having a high level of tannins. Blackwater streams are confined to southeastern Virginia.

Cold water rivers and streams are characterized by the presence of trout and a water temperature that rarely exceeds 70 degrees Fahrenheit during the summer months (DGIF personal communication 2014). Cold water streams are generally found along the Blue Ridge and in the western mountains.

Non-tidal warm water rivers and streams encompass all rivers that are not cold water trout streams or tidally influenced. They represent the majority of streams and rivers within Virginia (Anderson et al. 2013). It is important to note that cold water rivers face challenges that the warm water aquatic systems do not experience. These additional threats are highlighted below.

Over 60 percent of Virginia's Action Plan species depend on one of these aquatic habitats. In reviewing their basic habitat needs, clean water and unsilted substrate were frequently identified as fundamental water quality requirements for many SGCN. Virginia's first Wildlife Action Plan indicated water quality can be impaired by a variety of factors and circumstances that allow or enhance the flow of sediment, chemicals, and nutrients into local watersheds. When input of these pollutants is negligible, water quality remains unimpaired; however, in cases when the flow of these materials is significant, water quality is often degraded to the point of threatening wildlife populations and human health.

Since the National Clean Water Act was implemented in the 1970s, substantial improvements have been made that curb point source pollution and water quality has dramatically improved. Non-point source pollution, however, continues to be a major threat to waterways in the state (Duke University et al. 2009). DEQ serves as the Commonwealth's lead agency for identifying and addressing nonpoint source pollution. DEQ staff test Virginia's waters to detect pollutants and identify threats to human health and safety. Water bodies that do not meet water quality standards are designated as being impaired. Water bodies are designated as impaired if they are found to:

- Exceed ambient water quality standards for aquatic life and human health;
- Require fishing restrictions or advisories;
- Require restrictions on the consumption of shellfish due to contamination;
- Show an over-enrichment of nutrients;
- Demonstrate significant declines in aquatic life biodiversity or populations; and/or
- Demonstrate sediment contamination at levels which violate water quality standards or threaten aquatic life or human health (DEQ 2014).

Under section 303d of the Clean Water Act, many of the most severely impaired waters require a Total Maximum Daily Load (TMDL) be identified. The TMDL represents the total pollutant a water body can assimilate and still meet water quality standards. Once a TMDL has been established, DEQ staff, partners, and the public collaborate to create a Water Quality Improvement Plan that identifies and prioritizes actions needed to restore water quality.² This Action Plan recognizes the 325 watersheds with a TMDL and Water Quality Improvement Plans as conservation priorities for aquatic and riparian habitats (Figure 3.3).

² A current list of available Water Quality Implementation Plans can be found on DEQ's website: <http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLImplementation/TMDLImplementationPlans.aspx>

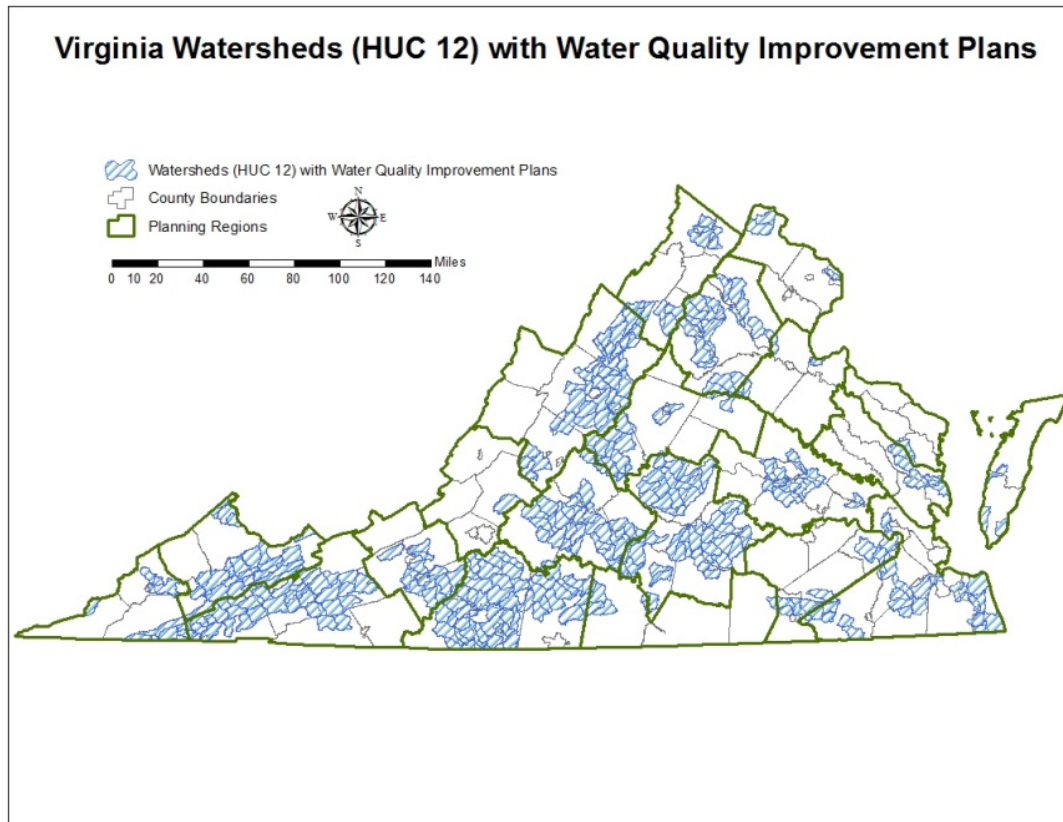


Figure 3.3. Virginia Watersheds with Water Quality Improvement Plans.

Some conservation partners have expressed concern about establishing a strong connection between the Action Plan and the TMDL program. These concerns warrant discussion.

1. The first concern involves the issue that some watersheds containing blackwater or swamp systems have naturally occurring lower levels of dissolved oxygen or low pH. Under TMDL guidelines, many of these watersheds could be classified as impaired even though the systems are healthy.
2. The second concern relates to how aquatic macroinvertebrates are used for biological monitoring under the TMDL system. Many macroinvertebrates are sensitive to pollutants, and monitoring changes in these invertebrate communities provides a reasonable measure of water quality. However, data are compiled at the taxonomic levels of genus or family, not at the species level (DEQ 2013). This approach may be appropriate to assess water quality for human health, but it does not provide specific enough data for identifying water impairment at a level that may be impactful on resident aquatic wildlife species. Aquatic wildlife can exhibit dramatically different tolerances to variations in stream flow or water chemistry, even if they are closely related. For example, the pheasantshell mussel (*Actinonaias pectorosa*) is in the taxonomic family Unionidae, is native to the Clinch River, and does not appear to be imperiled or in decline. Other members of this taxonomic family, such as the dromedary pearlymussel (*Dromus dromus*) and the elephantear (*Elliptio crassidens*) also occur in the Clinch River, but the dromedary pearlymussel is listed within the Wildlife Action Plan as a Tier I species (critical conservation need) and the elephantear is listed as a Tier IV species (moderate conservation

need). By not evaluating rivers by the species they support, it is possible important wildlife conservation issues will not be identified.

3. There are instances where wildlife may be more sensitive to impairments than human communities or the invertebrates that are monitored to represent all wildlife. For example, the bridge shiner (*Notropis bifrenatus*) is a Tier I fish that hunts by sight. This shiner's ability to feed is impaired by even moderate levels of turbidity (Jenkins and Burkhead 1993). While a mild erosion issue would be unlikely to impact human communities and result in a TMDL, it could significantly impact the persistence of downstream bridge shiner populations.
4. Finally, impaired waters are described as stream segments. When monitoring for human health impacts, this level of precision is necessary to help the public avoid degraded areas. However, several aquatic biologists have noted that water quality impairments often reflect conditions throughout the entire watershed. This Action Plan is designed to address wildlife habitat, and focusing on efforts at the exact location of impairment may not be the most effective strategy for addressing water quality impacts upon habitat. Entire watersheds are prioritized for action as opposed to focusing only on impaired segments.

Despite these drawbacks, the TMDL system has a number of important strengths that will enhance Action Plan implementation. The TMDL program represents an ongoing, statewide, effort to measure and monitor water quality and make that information available to the public. Accessing and utilizing these data do not require human or financial investment on the part of DGIF or other members of the wildlife conservation community. Additionally, the Water Quality Improvement Plans were created to address water quality impairments, identify sources of those impairments, and describe actions needed to address those issues. While these plans are driven by human health concerns, the vast majority of TMDL impairments indicated within the improvement plans, such as eroding shorelines; degraded riparian vegetation; and the flow of fecal matter, fertilizers, and other harmful substances into rivers, also threaten wildlife populations. The Water Quality Improvement Plans, created with significant local collaboration and input, also articulate actions which, if implemented, address the documented impairments. Integrating these actions into the Action Plan allows practitioners to focus on conservation actions that have already been vetted through a formal public review process.

Finally, the issue of geographic specificity (stream reaches versus watersheds) can be addressed using GIS. The U.S. Geological Survey's National Hydrography Dataset has subdivided Virginia's landscape into 1,278 units known as HUC12 watersheds (Weary and Doctor 2014). Each HUC12 watershed ranges from 15 square miles to 65 square miles. DGIF used DEQ's map of impaired stream reaches to develop a map identifying the 325 HUC12 watersheds that contain impaired waters for which a TMDL plan has been written. Lacking a different system of similar rigor, Virginia's Wildlife Action Plan will utilize the Virginia TMDL framework to identify priority HUC12 watersheds for restoration and describe actions needed to improve aquatic habitat conditions.

An analysis of the existing Water Quality Improvement Plans indicates the most significant threats to water quality often relate to the management of riparian and upland areas. The most significant sources of water quality impairments include:

- Livestock allowed access to streams or insufficient controls to prevent animal waste from flowing into streams;
- Lack of vegetated riparian buffers;

- Lack of trees or other vegetation on highly erodible lands;
- Lack of cover crops on agricultural fields;
- Failing septic systems and “straight pipes” that deposit human waste into streams;
- Insufficient stormwater controls to prevent the flow of bacteria, phosphorus, and sediment into streams from areas with high levels of impervious surfaces; and
- Pet waste entering waterways.

Water Quality Improvement Plans also identified wildlife as a contributing source of fecal coliform impairments. Although no species were identified, it is assumed that deer, waterfowl, and aquatic mammals such as beaver, muskrat, and otter are the most likely contributors. At present, none of the existing plans discuss this issue in any detail or provide actions that can be taken to address this wildlife-related concern. Lacking additional guidance, it is assumed that the recommended list of conservation actions (see below) will help address at least some of the wildlife-related concerns. Broader, species-specific, conversations may be required.

A summary of each water quality improvement plan is provided as part of the aquatic habitat discussion within each Local Summary. The most frequently cited conservation actions include:

- Working with landowners to exclude livestock from streams;
- Establishing vegetated riparian buffers along waterways, especially along pastures and croplands to minimize soil erosion and the overland flow of fertilizers, pesticides, herbicides, and fecal material into streams;
- Repairing, stabilizing, and restoring stream banks to minimize erosion;
- Revegetating highly erodible areas and providing sediment retention/control to prevent sediment from flowing into streams;
- Maintaining cover crops on cropland to minimize the flow of sediment, fertilizers, pesticides, and herbicides into streams when fields are not being used to produce other crops;
- Repairing or replacing failing septic systems and eliminating “straight pipes” depositing human waste into streams;
- Maintaining and expanding systems to manage storm water runoff to prevent bacteria, phosphorous, and sediment from flowing into streams from areas of impervious surface;
- As needed, working with pet owners to implement a program to prevent pet waste from flowing into streams; and
- As needed, working to enhance sewage pump out sites for boats.

Cold Water Streams

As indicated previously, cold water streams include water bodies that do not exceed 70 degrees Fahrenheit for extended periods (DGIF personal communication 2014). Brook trout is an Action Plan species that relies upon these cold water habitats and will be used to represent other similar cold water species. In addition to many of the issues identified for other rivers, cold water streams may also be degraded by thermal impairments and acid deposition.

Low water temperatures are maintained in cold water streams through stream shading and cold groundwater inputs. If trees are removed from these riparian areas or if the flow of groundwater into streams is disrupted, water temperatures can become too warm to support brook trout and other cold water species. The 2011 Eastern Brook Trout Joint Venture Conservation Strategy stresses the value of

healthy riparian buffers and the utility of working with public and private landowners to restore riparian forests to improve degraded habitats (Eastern Brook Trout Joint Venture 2011). Working to maintain forest cover and minimizing the amount of impervious surface within a watershed will help maintain the infiltration of water into the groundwater system.

Many of Virginia's cold water streams are impacted by acidic precipitation. When acidic rain enters a stream, water chemistry is altered, which may eliminate or significantly degrade brook trout habitats. As indicated by the Eastern Brook Trout Joint Ventures Conservation Strategy adding lime (coarse limestone sand) to a stream can temporarily mitigate the impact of acid precipitation. While it is not a permanent solution, DGIF biologists have employed this technique to maintain specific brook trout populations (Eastern Brook Trout Joint Venture 2011). DGIF will continue collaborating with private, state, and federal partners to implement efforts to improve the condition of cold water habitats.

High Integrity Watersheds

As indicated previously (see Habitat Focus), the Virginia Watershed Integrity Model considered a variety of biotic, abiotic, and human use factors to consider the quality of Virginia's watersheds and identify high quality drainages. In addition to restoring the quality of impaired waters, it is important that Virginia's conservation community work to maintain the health of Virginia's High Integrity watersheds (Figure 3.4). DGIF will continue collaborating with private, state, and federal partners to implement efforts to maintain or improve the quality of water within these watersheds. Information on high priority watersheds have been provided within each Local Summary and these data will be updated as new information becomes available.

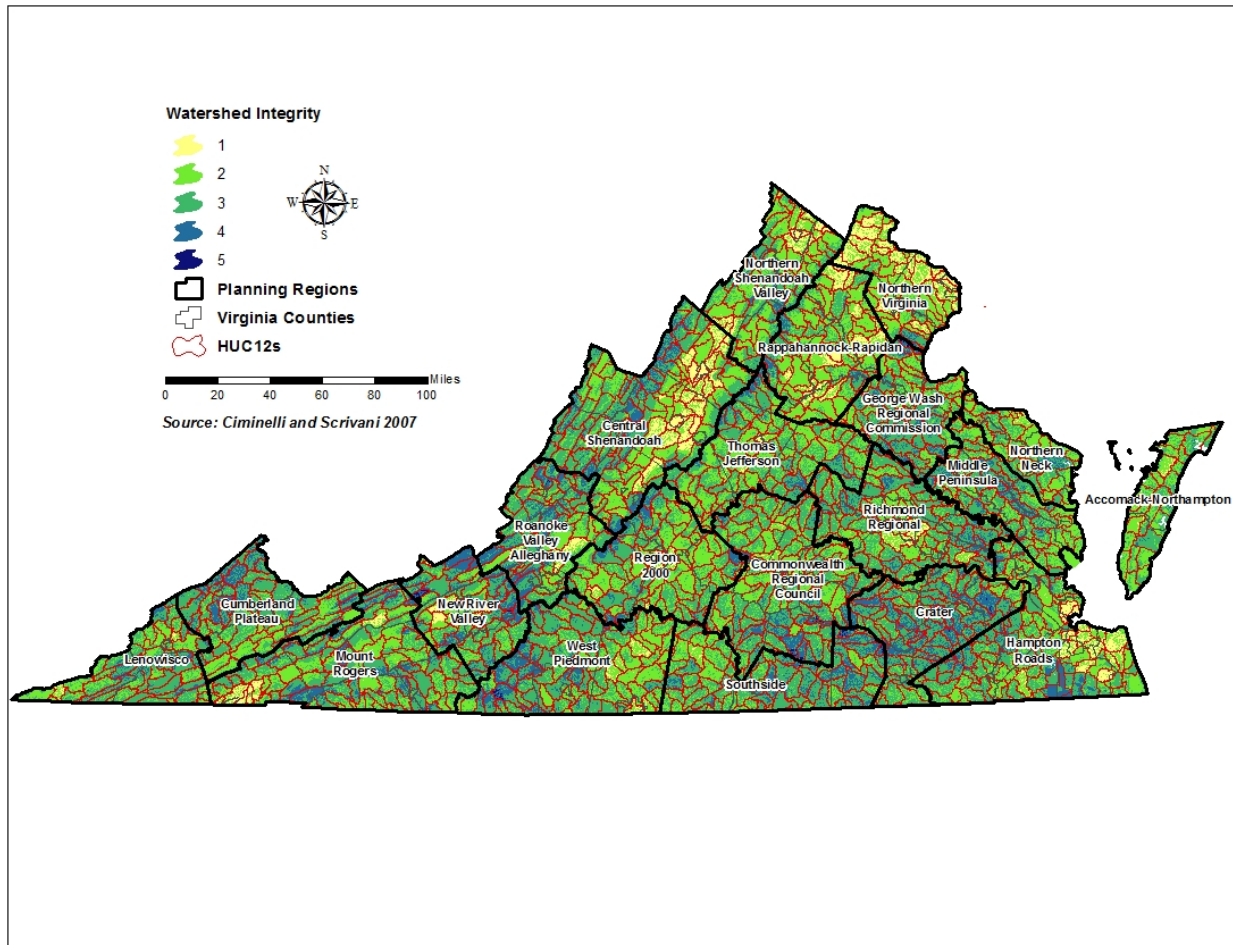


Figure 3.4. Virginia Watershed Integrity Model (Ciminelli and Scrivani 2007).

Aquatic Connectivity

A lack of aquatic connectivity has been identified as a significant threat to the conservation of aquatic SGCN (Martin and Apse 2013) (DGIF 1991) (Martin et al. 2014). DGIF implements a Fish Passage program that works to enhance aquatic connectivity by either removing or modifying dams and other impediments so that fish and other aquatic species may move more freely throughout individual watersheds. This program has been funded with State Wildlife Grants and other resources. DGIF intends to continue using State Wildlife Grants and other resources to enhance the connectivity of Virginia's rivers. Likewise, these resources may be used to document the effectiveness of these restoration efforts by monitoring changes in habitats, water quality, and aquatic wildlife communities after the impairment has been removed or modified. It is DGIF's intent to use the Chesapeake Bay Fish Prioritization Tool, the Southeast Aquatic Connectivity Assessment Tool, landowner willingness, and other criteria to identify priority areas (Figure 3.5) for work during DGIF's annual budgeting and work planning process.

grow and create a canopy that eliminates the open character of these habitats. Open habitats must be managed using fire or other tools that preserve their openness.

Glades and Barrens

Glades and barrens are naturally occurring open habitats that are characterized by shallow soils and rocky substrates. These habitats generally have a grassy layer with some low shrubs and herbs and scattered trees (often less than 40 percent of tree cover) as well as patches of moss and lichen (Anderson et al. 2013; Fleming et al. 2013; Comer 2003). Open rocky areas can also be predominant (Comer 2003). Glade and barren habitats are found in 12 planning regions in the more central and western portions of the state.

Glades and barrens represent distinct botanical communities (C. Ludwig, VA Dept. of Conservation and Recreation, Natural Heritage Program, personal communication 2015). Because of their small size, prolonged disturbances can eliminate these botanical communities, and because these habitats tend to be geographically isolated, once a community is eliminated, it may be impossible for many species to reoccupy a site without human intervention. Historic threats to these systems have included intense quarrying, which has resulted in loss of many habitat patches and the fragmentation of surrounding areas (Anderson et al. 2013). Some glades and barrens occur within agricultural lands, which also can lead to fragmentation and degradation of the habitat from overgrazing. The introduction of non-native and invasive species threatens native species endemic to these habitats, and recreational activities within these habitats often results in trampled vegetation (USFS 2014).

In order to conserve glade and barren habitats, the conservation community can work collaboratively with public and private landowners to conserve these areas either through easement, acquisition, or agreement. As agencies consider land acquisitions, they should consider giving greater priority to properties that contain current or historic glade and barren habitats. Where these habitats have been conserved, important management actions include prescribed burns and managing wildfires, monitoring and controlling non-native species, and managing the recreational use of areas to prevent the trampling of rare plant communities (USFS 2014).

Savannas

Savannas are unique communities dominated by large mature trees, open canopies, low densities of young trees, and abundant grass and forb ground covers. A few examples of hardwood savannas occur on military installations in northern and eastern Virginia and small acreages of longleaf pine savanna occur on conserved lands in southeast Virginia. Historically, savannas would have been maintained by wildfires or anthropogenic fires that would have removed shrubs and young trees while leaving mature trees intact. Today, savannas are maintained by prescribed fire. While existing savanna habitats can be maintained with management, new savannas are not likely to be created through natural processes.

While savannas offer unique habitat conditions that can support an assortment of species, they have limited economic value. As such, few private landowners can afford to manage their properties to include a savanna habitat. Historic fire suppression on conserved lands has allowed diverse mixed forest communities to exist in areas that were once savanna communities. The only viable means of creating and maintaining savannas involves working with public and private landowners to conserve areas through acquisition, easement, or agreement and managing those areas with fire to preserve mature trees while eliminating younger aged trees and shrubs. To maximize the benefit of these efforts,

Virginia's conservation community should focus such efforts on areas either adjacent to, or in close proximity to, existing savanna habitats.

Post Agricultural (Old Field) Habitats

Post-agricultural habitats include fields, orchards, or pastures that are taken out of production and allowed to go fallow. Two basic circumstances can result in the creation of a post-agricultural habitat. First, changing markets or other circumstances create a situation where a property is economically unviable. In other instances, a conservation-minded landowner may choose to manage portions of their property as habitat for some suite of wildlife. Although it can be incredibly useful from a wildlife management perspective, very little post-agricultural habitat exists in Virginia. Relatively high crop prices and the potential for a developing biofuels industry allow many agricultural properties to remain economically viable. In many cases, despite a desire to provide habitat, many landowners lack the financial means needed to bring portions of their property out of production. Likewise, some agricultural landowners may be influenced by a persistent cultural attitude that fallow land represents a management failure by the owner.

Small acreages of post-agricultural lands can be found throughout Virginia, and these can be managed to provide a diversity of wildlife habitats. Unfortunately, because these lands may be valuable for agricultural purposes, they tend to be very expensive to acquire. Despite this, the diversity of management opportunities makes these areas desirable for wildlife conservation. Agriculturally viable soils are one factor considered by the DGIF when evaluating a parcel for acquisition, because healthy soils facilitate establishment of beneficial habitats. When retired agricultural lands have been conserved, their unique habitat conditions tend to persist for 10 to 20 years before maturing into a different (likely a forested or shrub) habitat type. Working with willing private landowners to conserve these properties through acquisition, easement, or agreement will provide a means of bringing these properties into a conserved state.

One of the primary programs for conserving and restoring open habitats within Virginia is Virginia's Quail Recovery Initiative (QRI), which is a robust multi-partner effort. While the QRI uses quail as a focal species, quail compatible habitats are known to support a suite of other SGCN including field sparrows, eastern towhees, brown thrashers, prairie warblers, seven bumble bee species, and the monarch butterfly. QRI efforts are directed towards six focus areas based upon Soil and Water Conservation Districts (SWCD). The six focus areas include:

- Chowan Basin SWCD – covers Sussex, Southampton, and Greenville Counties;
- Halifax SWCD – covers Halifax County;
- Big Walker SWCD – covers Bland and Wythe Counties;
- Headwaters SWCD – covers Augusta County;
- Culpepper SWCD – covers Green, Orange, Madison, Culpepper, and Rappahannock Counties;
- and
- Three Rivers SWCD – covers Essex, King and Queen, and King William Counties

These six districts will be recognized as priorities for open habitat conservation within the Action Plan. As the QRI is updated or adapted, new priorities will be incorporated into the online version of the Action Plan.

Forest Habitats

Virginia's forests cover approximately 62 percent of Virginia (15.8 million acres), of which 15.3 million acres are available for commercial harvest, and 500,000 acres are reserved forested lands (or lands not in production) (DOF 2010). More than 12.9 million acres (over 80 percent) of forests in the state are privately owned, while approximately 16 percent of the forested area is publicly owned (owned by federal, state, or local agencies) (DOF 2010). The USFS manages the largest portion of public forested lands, 1.6 million acres, while Virginia's DOF manages 65,000 acres in 20 different state forests (DOF 2010). There are two main types of forests described within this Action Plan – mixed hardwood/ conifer and spruce fir. Mixed hardwood and conifer forests can host a range of oak, hickory, and pine species, including pitch pine (*Pinus rigida*), Table Mountain pine (*P. pungens*), shortleaf pine, white pine, white oaks, southern red oak, northern red oak, chestnut oak, and live oak (Comer et al. 2003). Other tree species that may be found in these forests can include red-cedar, American beech, sugar maple, American basswood, and yellow birch, among others (Comer et al. 2003).

Mixed Hardwood/ Conifer Forests Habitats

Mixed hardwood and conifer forests are found across the state and in all 21 Planning Regions. They make up a large percentage of existing forests. However, threats and conservation actions can vary slightly depending on the location. Threats and conservation actions are described below for mixed hardwood/conifer forests west of the Piedmont and mixed hardwood/conifer forests in the Piedmont and Coastal Plain. Additionally, there are five specific types of mixed hardwood and conifer forests in the state that face varying sets of threats and actions as well. These five forest types (young forests, North Atlantic coastal plain maritime forest, Central Atlantic coastal plain maritime forest, Southern Atlantic coastal plain upland longleaf pine woodland, and Southern Appalachian low elevation pine forest) will be described in more detail individually below.

The habitat value of mixed hardwood and conifer forests west of the Piedmont is limited by a lack of oak and pine regeneration (USFS 2014). This issue is of most concern on publicly owned forests and is of minimal concern on private forests. Information from the Virginia Forest Inventory Assessment indicates less than 5 percent of Virginia's mountain forests are younger than 10 years (DOF 2010). The lack of any regeneration was identified by many Action Plan contributors as being the single greatest challenge for wildlife conservation in Virginia's western mixed hardwood/ conifer forests. While mature forest habitats provide benefits to an assortment of aquatic and terrestrial species, the conspicuous lack of young forest habitats severely limits opportunities for open habitat species such as the northern bobwhite quail, golden-winged warbler, field sparrows, eastern towhees, brown thrashers, prairie warblers, chestnut sided warbler, yellow breasted chat, ruffed grouse, American woodcock, and bumble bee species.

Many of these habitats on federal lands are impacted by destructive insect species (USFS 2014). Gypsy moth (*Lymantris dispar dispar*) caterpillars and emerald ash borer (*Agrilus planipennis*) larva are particularly destructive to oak and ash, respectively. Various pine bark beetle species (Family Scolytidae) infest pine species. In each of these cases, insect activity can either kill mature trees or stress infested trees to the point they become vulnerable to other pests and diseases (Virginia Tech 2008). Impacts from insects can vary from year to year with the greatest effects occurring during outbreak years when large insect populations can affect large numbers of trees over a wide area.

Finally, conservation partners identified acid precipitation and climate change as threats that degrade these forested habitats at higher elevations (i.e., above 3000 feet). The USEPA indicates that acid

precipitation can stress trees either by enhancing the leaching of soil nutrients or by dissolving rock and releasing toxic elements such as aluminum into the soil (EPA website 2012). Trees at higher elevations can also be affected by acidic clouds and fog that damage leaves and needles. While acidic precipitation may not immediately kill trees, the additional stress often makes trees susceptible to other issues such as diseases and invasive species. At the current time, no viable on-the-ground management strategies have been identified to address acid precipitation.

In terms of conservation actions, the restoration of successional processes was identified by conservation partners as the most important effort that could be undertaken within the mixed hardwood/ conifer forests on public lands in the western portions of Virginia. Such efforts would provide a greater diversity of habitats capable of supporting dozens of SGCN. In 2014, the USFS determined the desired ecological condition for broad groups of oak forest types in the George Washington National Forest would include a mosaic of compositional and structural diversity of patches, articulated in various age classes and canopy conditions (Tables 3.3 and 3.4) (USFS 2014). These desired conditions could be achieved and maintained through natural disturbances, timber harvest and the use of prescribed fire.

Table 3.3. Desired Ecological Condition of Oak Forest by Age Class (USFS 2014).

Structure	Open	Mid-Successional Closed Canopy	Mid- Successional Open Canopy	Late Successional Open Canopy	Late Successional Closed Canopy
% of ecological system	12	7	10	57	14
Age	0-15	16-69	16-69	70+	70+

Table 3.4. Desired Ecological Condition of Pine Forest by Age Class (USFS 2014).

Structure	Early	Mid-Successional Closed Canopy	Mid-Successional Open Canopy	Late Successional Open Canopy	Late Successional Closed Canopy
% of ecological system	13	3	25	54	5
Age	0-15	16-70	16-70	71+	71+

Other important conservation actions include working with industry and localities to create development plans that avoid priority forest patches as well as maintaining robust forest buffers along rivers, wetlands, and unique botanical communities such as glades and barrens.

Issues impacting hardwood and conifer forests in the eastern portions of Virginia are distinctly different from the issues impacting similar forests in the western portions of the Commonwealth. For example, forests in the eastern portion of Virginia have a much greater diversity of age structures (DGIF personal communication 2014). They also tend to be more highly fragmented and at greater risk of being converted to other land uses (Anderson et al. 2013). Action Plan partners also noted that these forests are affected by a greater number of invasive species than are found in the west portions of Virginia.

The loss or fragmentation of hardwood and conifer stands was identified by conservation partners as being the single greatest threat to this habitat in the eastern portions of Virginia. In many cases, as with urban or commercial development, the losses can be complete and have profound impacts on local wildlife species composition, water quality, and outdoor recreational opportunities. In other cases, such

as conversion to pine plantations, one specific forest habitat is lost, but these lands can be managed as open habitats that support a diversity of other landowner goals, wildlife species, and recreational opportunities. If BMPs established by the Virginia DOF are followed, impacts to waterways and adjoining properties may be prevented or mitigated (DOF 2011).

Actions for conserving hardwood and conifer forests in Virginia's piedmont and coastal plain include working to conserve, either through acquisition, easement, cooperative management, or incentives large intact forest patches capable of supporting a variety of SGCN. Initial priorities for conservation include patches of hardwood and conifer forests adjacent to conserved lands (wildlife management areas, state parks, national parks, municipal parks, Heritage sites, national wildlife refuges, etc.) and forests buffering rivers, streams, wetlands, and unique botanical communities. These networks of secured lands could be enhanced with new areas to achieve larger, more functional forest cores that are buffered and connected. TNC's Resilient Sites for Terrestrial Conservation analysis can be used to help identify and prioritize protection and conservation of sites that would contribute to a resilient network of forests as well as provide habitat for SGCN (Anderson et al. 2012).

Young Forests

The term "young forest" is loosely defined and refers to areas dominated by woody seedlings and saplings (Oehler et al. 2006). The term can be applied to any forest type. Previously, young forests have been referred to as a form of early successional habitat. Virginia's forests, especially on public lands in the western portions of the state, lack significant areas of young forests. Given that young forest habitats support a multitude of Action Plan species, DGIF is actively involved with the Wildlife Management Institute's Young Forest Initiative.

Prior to European contact, a variety of natural and anthropogenic disturbance factors resulted in some portion of a forested landscape in North America being made up of younger forest age classes (Oehler et al. 2006). Disturbance factors included floods, hurricanes, ice storms, insect outbreaks, wild fires, and human induced fires. During later periods, logging and land clearing also produced significant amounts of young forest habitat (Oehler et al. 2006). During the last century, with flood control and fire suppression, many of the natural forces that create young forest have been minimized or altered. Likewise, in many parts of the country, logging has become less economically viable – especially on public lands. These altered natural disturbance regimes have resulted in a significant decline of young forests.

Areas can retain young forest conditions for up to 50 years post disturbance, depending upon the location, soil fertility, tree species, and other variables (Oehler et al. 2006). The Wildlife Management Institute, however, indicates young forest conditions are more likely to remain for 15 to 20 years before the botanical community transitions into a mature forest type. Although patches young forest habitats are found throughout Virginia, due to their transient nature, these habitats are profoundly difficult to represent geographically. Young forests are most prominent in the Coastal Plain and southern Piedmont. Of the young forests in the Coastal Plain, many have been planted as pine plantations. These plantations are most likely to occur on private lands (DOF personal communication 2014).

Timber harvest and prescribed fire are the two primary means of creating a young forest habitat from a mature forest habitat (Oehler et al. 2006). The effectiveness of each process will be influenced a variety of factors, including:

- What types of wildlife the manager is interested in conserving?
- What are the current and past conditions of the property (soil type, slope, land use, etc.) that will influence the ability to achieve management goals?
- Does the land have the potential or inherent ability to produce the types of habitats needed for the target wildlife species?
- How large is the property?
- How does the property fit into the overall landscape perspective?
- What management actions are needed to achieve the desired young forest conditions?

Within the Technical Manual, *Virginia's Forestry Best Management Practices for Water Quality* (2011), DOF has established BMPs to help land owners and property managers plan and execute both timber cuts and prescribed burns in ways that achieve management goals and prevent undesirable impacts for young forests (DOF 2011).

North Atlantic Coastal Plain Maritime Forest

Patches of North Atlantic Coastal Plain Maritime Forest are found along the shores of the eastern portion of Virginia, north of the James River and along Virginia's Eastern Shore barrier islands. This forested habitat may be adjacent to or mixed within dune, swale, or beach habitats. Because of its proximity to the coastline, this forest type typically has few tree species and trees are often stunted. A dense vine layer may also be present (Anderson et al. 2013). Depending on location and exposure to maritime forces, tree species vary but can include pines (e.g., pitch, Virginia, loblolly, and shortleaf pine) and oaks (e.g., scarlet, black, scrub, and post) and eastern red cedar, black cherry, American holly, sassafras, and red maple. Vegetation and habitat is affected by salt spray, wind, sand and dune deposition, and sometimes inundation (Anderson et al. 2013).

There is some disagreement regarding the amount of this habitat that remains in Virginia. In 2007, the Virginia Institute of Marine Science (VIMS) completed a survey to delineate and determine the current distribution of maritime forests in Virginia (Berman and Berquist 2007). Their review of satellite imagery and field surveys indicated that 1,389 acres of this habitat remains, and these communities are only found on the Eastern Shore. This report also indicated over 88 percent of the remaining north Atlantic coastal plain maritime forests occur on conserved lands. By contrast, Anderson et al. indicated Virginia possesses over 14,000 acres along both the eastern and western shores of the Chesapeake Bay (2013). Anderson et al. estimates that 15.6 percent of this habitat occurs on conserved lands (2013). The primary distinction between the two models appears to involve the classification of appropriate soils, the inclusion of wetlands, and distance from a coastal shoreline. The VIMS model included a significant ground survey, specifically targeting maritime forests while the Anderson et al. model was evaluated more generally (2013).

Berman and Berquist (2007) indicate climate change, including sea-level rise and projected increasing storm intensity and frequency, and development are the principal issues threatening these remaining patches of north Atlantic coastal plain maritime forests. When practicable, efforts to reconcile the two habitat maps would help determine if additional acres of north Atlantic coastal plain maritime forest exists. If such habitats are found, it would be advantageous for agencies to work with willing landowners to bring those habitat patches into conservation through acquisition, easement, incentive, or agreement. Given that the vast majority of known acreage has already been conserved, the near-term threat of extirpation is likely slight.

Central Atlantic Coastal Plain Maritime Forest

This forest type includes a mosaic of forests and shrublands on Atlantic Coast barrier islands and similar coastal strands from Virginia Beach to central South Carolina. Typically less than two miles from the ocean, these maritime forests are influenced by salt spray, extreme disturbance events, and the distinctive climate of the immediate coast. Salt-tolerant evergreen tree species are most common, particularly live oak, wax-myrtle, and loblolly pine. Embedded freshwater depressional wetlands are typically dominated by shrubs or small trees, such as red maple, swamp tupelo, stiff dogwood, or swamp bay (Anderson et al. 2013).

There is also some disagreement regarding the amount of this habitat that remains in Virginia. In 2007, the Virginia Institute of Marine Science (VIMS) completed a survey to delineate and determine the current distribution of maritime forests in Virginia (Berman and Berquist 2007). Their review of satellite imagery and field surveys indicated that 2,704 acres of this habitat remains within the borders of Virginia Beach. This report also indicated all of the remaining central Atlantic coastal plain maritime forests occur on conserved lands. By contrast, TNC indicates Virginia possesses almost 6,300 acres (2013). Anderson et al. (2013) estimate that over 88 percent of this habitat occurs on conserved lands. The primary distinction between the two models appears to involve the classification of appropriate soils, the inclusion of wetlands, and distance from a coastal shoreline. The VIMS model included a significant ground survey, specifically targeting maritime forests while the Anderson et al. model was evaluated more generally.

Berman and Berquist (2007) indicate climate change, including sea-level rise and the threat of increasing storm intensity and frequency, and development are the principal issues threatening these remaining patches of central Atlantic coastal plain maritime forests. When practicable, efforts to reconcile the two habitat maps would help determine if another 3,600 acres of central Atlantic maritime forest exists. If such habitats are found, it would be advantageous for agencies to work with willing landowners to bring those habitat patches into conservation through acquisition, easement, incentive, or agreement. Other than working to support the management and conservation actions at Back Bay National Wildlife Refuge, False Cape State Park, and First Landing State Park, additional conservation actions do not appear to be warranted at this time.

Southern Atlantic Coastal Plain Upland Longleaf Pine Woodland

Southern Atlantic coastal plain upland longleaf pine woodland is found in a few small patches in southeastern Virginia within the coastal plain on sites characterized by sandy soils. Specific forest composition varies based upon management. In areas that experience infrequent fires, oaks (e.g., southern red, post, blackjack, turkey) dominate, while areas with more frequent fires are dominated by longleaf pines. The understory may be made up of scrub oaks or heath shrub. This forest type was once more prevalent in Virginia, but with clearing, agricultural conversion to other species and fire exclusion over the decades, longleaf pine has largely been replaced by loblolly pine (Anderson et al. 2013).

Anderson et al. (2013) indicate fewer than 600 acres of this forest type occur in Virginia. Of these, 28 percent occur on conserved lands. Although longleaf pine has a variety of economic values, many private landowners find loblolly pines to be a more viable economic alternative (DOF 2007). In the near term, priorities for conserving and restoring longleaf pine woodlands should focus on working with willing landowners to conserve the remaining stands of southern Atlantic coastal plain upland longleaf pine woodlands either through acquisition, easement, or agreement and continuing efforts to restore

longleaf pines to forest communities on conserved lands. Opportunities may also exist to collaborate with private landowners to help restore longleaf pines to forest communities through easements, incentives, or cooperative agreements. Priority needs will focus on private lands that are either adjacent, or are in close proximity to, existing longleaf pine stands and pine savannas.

Southern Appalachian Low Elevation Pine Forest

This habitat is described as an open forest or woodland of acidic substrates at low elevations in southwest Virginia (Anderson et al. 2013). Vegetation is dominated by Virginia pine and shortleaf pine, occasionally with pitch pine. Hardwoods may be abundant, especially dry-site oaks such as southern red oak, chestnut oak, and scarlet oak, but also pignut hickory, red maple, and others. A heath shrub layer may be well developed. Herbs are usually sparse, though communities of this system may have been grassy when fires were more frequent. The ecological character and natural distribution of this system has been obscured over the years by the loss of shortleaf pine due to human settlement, universal logging, pine beetle outbreaks, and fire suppression (Anderson et al. 2013). Despite the forest type's tolerance for a wide range of ecological conditions and its economic viability, the Virginia Cooperative Extension indicates a decline of almost 90 percent of shortleaf acreage since 1940 (Gagnon and Johnson 2009).

Given the dramatic decline of shortleaf pine in recent decades, there is a growing realization that shortleaf pine restoration is warranted. Such restoration efforts could potentially benefit a number of SGCN including northern bobwhite and red cockaded woodpecker (Burns et al. 1990). Working to restore or enhance shortleaf pine within existing patches of southern Appalachian low elevation pine forests as well as new areas would be beneficial. Efforts could occur on agency lands and in coordination with interested private land owners. Virginia Tech Cooperative Extension indicates growing and mature shortleaf pine benefit from thinning strategies (Gagnon and Johnson 2009). When working to establish new stands of shortleaf pine, especially if no shortleaf seed bank is expected to exist, the Virginia Tech Cooperative Extension recommends clear cutting and implementing an artificial regeneration technique such as direct seeding or planting seedlings (Gagnon and Johnson 2009).

Spruce-Fir Forest Habitats

Spruce-fir forests are found in western Virginia at elevations of 3,200 to 5,000 feet on high peaks that are cold and windy. Red spruce is predominant, along with Fraser fir in southwest Virginia and balsam fir in the northwest of the state (Anderson et al. 2013). Some significant areas of this forest type remain, but much of it has been lost and is now grass-shrub-hardwood scrub (Anderson et al. 2013). Spruce fir forests are typically found in older aged stands with a relatively high level of connectedness, likely due to the fact they are found higher upslope in areas with less development. Many of Virginia's spruce-fir forests were logged during the early 20th century. Anthropogenic fires, fueled by logging slash, converted large areas of former spruce-fir forest into a grass-shrub-hardwood habitat, and spruce-fir forests have not recovered to conifer dominance after 90 years (Anderson et al. 2013).

Virginia's remaining spruce-fir forests are impacted by a variety of threats. Invasive species such as the balsam woolly adelgid, the hemlock woolly adelgid, and the eastern spruce beetle cause considerable damage and mortality to Fraser firs, balsam firs, and red spruce throughout the southern and central Appalachians (Burns et al. 1990). Acid precipitation also has been a contributing factor to the decline of

spruce-fir forests in the eastern United States by damaging plant needles and altering soil chemistry (EPA website 2014). Collectively, these impacts can make trees more susceptible to disease and pest issues. Finally, recent climate models indicate that under current greenhouse gas emission scenarios, Virginia's climate could become unsuitable for red spruce by mid-century (Klopper et al. 2012).

Efforts to conserve spruce-fir forests should focus on several actions. First, maintaining conditions that will be favorable to growth and expansion in existing stands will be important (USFS 2014). Efforts to restore red spruce could be focused on areas that have existing populations of Norway spruce and red pine (USFS 2014). Planting red spruce seedlings should also be part of any restoration effort (USFS 2014). Working with landowners, forestry groups, planning district commissions, and others to ensure development in high elevation areas does not destroy or fragment these rare forest communities will be necessary. Robust review and commenting on any residential/ commercial development and energy development proposals from interested agencies and other groups could also help ensure conservation measures are taken or development is guided towards less sensitive areas.

Subterranean Habitats

Virginia has two basic categories of subterranean habitats – karst and groundwater. Karst habitats are created by complex interactions of water, bedrock, vegetation, and soils. Karst areas are often underlain by limestone or dolostone bedrock and characterized as landscapes with underground drainage networks (Figure 3.6). These areas contain sinkholes, sinking and losing streams, caves, and large flow springs (DCR website 2015). Maps of areas with karst features are provided within the local summaries. There are over 4,300 known caves in the state (DCR 2008). Karst systems provide important habitats for many SGCN invertebrates as well as bats. Karst habitats are primarily located in eight of the western planning regions; however, some smaller karst systems can be found in the Piedmont and Coastal Plain (DCR website 2008).

Several subterranean SGCN invertebrates occur in nonkarst aquifers. These species are rarely encountered but have been collected from wells and springs in the northern portions of the Piedmont and Coastal Plain (W. Orndorff and C. Hobson, Va Dept. of Conservation and Recreation, Natural Heritage, personal communication 2015).

These subterranean systems are some of the least understood habitats represented within Virginia's Action Plan. While these systems are distinct and each supports a unique set of fauna, these subterranean habitats are often impacted by similar threats and would benefit from similar conservation actions. For example, these subterranean habitats can only be sustained with clean and abundant water resources flowing through them. If water quality or water quantity is impaired, habitat suitability diminishes. Most water-related threats originate from surface land use, including pollution allowed to infiltrate into groundwater systems, over withdrawal of groundwater for human uses, dumping of garbage and other debris into sinkholes, and impervious surfaces that direct water away from groundwater recharge areas (DCR 2008).

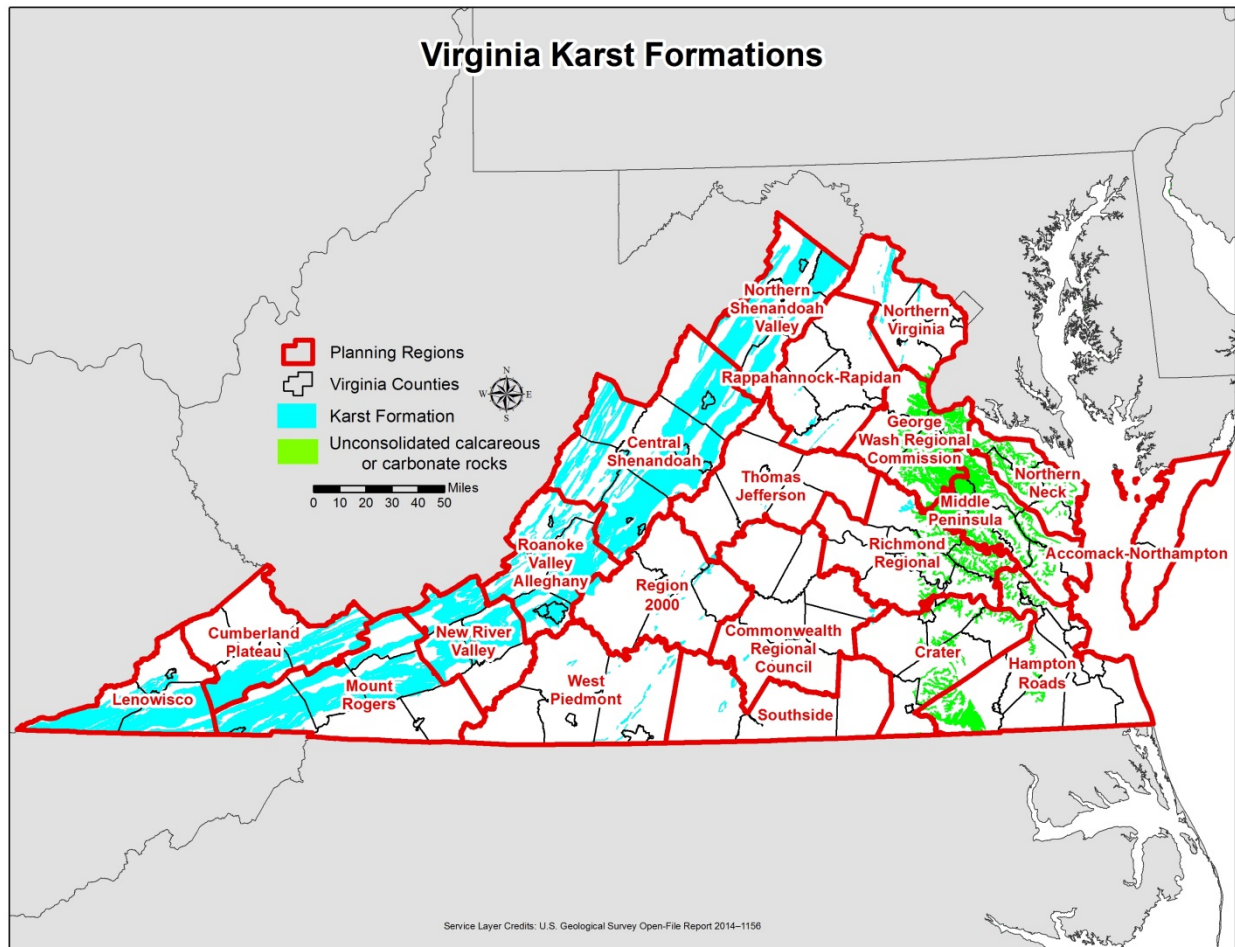


Figure 3.6. Virginia's Karst Formations (Weary and Doctor 2014).

Actions to conserve these habitats are limited by a lack of data describing how water enters and moves through the groundwater systems. Being underground limits the opportunities for direct observation, and access to wells and springs may be limited by private landowners. As such, it is impossible to provide specific guidance or prioritize specific areas for additional conservation. Until such data are available, general guidelines include maintaining as much vegetative cover as possible in areas that overlay karst topography or aquifers, establishing vegetative buffers around springs and sinkholes, and working to limit opportunities for surface pollution to contaminate springs and seeps.

Statewide Threats to Multiple Habitats

Invasive Species

In addition to the impacts invasive species have on wetland habitats (see above), the Virginia Invasive Species Management Plan identifies several species that have a profound impact on terrestrial ecosystems. Invasive species such as the gypsy moth, ramorum blight, sirex wood wasp, and emerald ash borer are known to kill large numbers of trees and alter forest health and composition. Invasive plant species, such as tree of heaven, privet, and Japanese stilt grass are aggressive colonizers, taking advantage of degraded natural habitats, outcompeting native species, and significantly altering the character and quality of local habitats. Virginia's Natural Heritage Program has identified over 90

invasive plant species. Additionally, invasive wildlife species such as fire ants and feral hogs are known to degrade the quality of native habitats, damage crops, kill native wildlife, and, in some cases, be dangerous to humans.

Unfortunately, there are insufficient human and financial resources in Virginia to eradicate all known invasive species. Virginia's Invasive Species Management Plan identifies seven goals (each with multiple strategies) for addressing invasive species issues in Virginia (VISWG 2012). These goals include:

- *Coordinate state, federal, and stakeholder prevention and management of invasive species infestations;*
- *Prevent known and potential invasive species from entering the state through detecting and interrupting all unauthorized species introductions;*
- *Promote and enhance professional and volunteer invasive species early detection through education and reporting tools;*
- *Enhance rapid response capability to implement eradication or containment procedures for target species through planning;*
- *Provide control of priority invasive species through containment, abatement, and other management strategies—including habitat restoration and use of native species—to minimize environmental and economic impacts;*
- *Support or conduct research, monitoring, and risk assessment necessary to assess, prioritize, and control invasive species; and*
- *Provide current information on invasive species, their negative impacts to environmental and economic resources, and methods of prevention and control to the general public, environmental nongovernmental organization, special interest groups and K-12 science teachers (VISWG 2012).*

Climate Change Impacts

Based on numerous regional and state specific research and reports, it is likely that Virginia's climate will change and have impacts on the state's fish, wildlife, and habitats. Climate change will likely affect these resources directly, but more importantly, climate change is expected to exacerbate existing threats such as water quality and habitat degradation. Although many climate impacts represent longer-term threats, some, with more immediate implications, such as more frequent storm events and heat waves/ higher temperatures, are already occurring. Understanding the impacts and what those changes may mean for species and habitats within Virginia is important to ensure conservation actions are robust and effective now and into the future. This section provides a general overview of likely climate impacts in Virginia, what those changing conditions may mean for species and habitats, and the types of climate-smart conservation actions will help address climate change impacts within the state.

All available climate models project the Northeast and Virginia will experience a substantial increase in temperature by the end of the century. A recent study focusing on the Northeast and Midwest notes that temperatures within the region may increase from 4°C to 5 °C by mid-century (Staudinger et al. 2015). The National Climate Assessment (NCA) is a national climate assessment that provides state level information. The NCA indicates Virginia's average temperature could increase by as much as 7°F by 2100 (Melilo et al. 2014). Virginia's 2008 Climate Action Plan projects that average temperatures in Virginia will increase by 3.1°C (5.6°F) by the end of the century (Governor's Commission on Climate Change, 2008). Although there are a range of projections, there is consensus that temperatures will increase. It

is likely that heat waves and more extreme temperatures will also become more prevalent (Staudinger et al. 2015).

Models also project that precipitation yearly averages will likely increase in the Northeast due to more intense rainfall events. However, precipitation events will likely become less frequent but last longer (Staudinger et al. 2015). In turn, this may mean more dry spells, and with projections showing increases in precipitation more likely to occur in winter and spring months. As a result, this may mean more droughts in the summer months as well as more flooding, during the more intense events (Staudinger et al. 2015; Pyke et al. 2008). It is important to note that precipitation projections are less robust than those for temperature due to the difficulty in simulating the complex processes related to precipitation (Staudinger et al. 2015). Specifically, in Virginia the NCA projects a 6 percent increase in precipitation (Melillo et al. 2014). Observation data has already shown an 11 percent increase in the amount of precipitation occurring during a storm (intensity) within the state from 1948 to 2011 (VIMS 2013; Madsen and Wilcox 2012). Models project that storms will become more intense along the Atlantic Coast region (Staudinger et al. 2015). Frequency of extreme storm events has also increased over the last 50 years (VIMS 2013). More intense or frequent storm events will likely result in an increase in storm surges and flooding in coastal areas (CCSP 2009; VIMS 2013; Staudinger et al. 2015).

Sea-level rise is also likely to be significant in Virginia, with recent studies projecting rates higher than originally estimated on the East Coast (Sallenger et al. 2012). Historic data demonstrates that sea levels have risen over 1.5 feet in the Mid-Atlantic region since 1900 and a foot in the last 80 years in the Hampton Roads area (Staudinger et al. 2015; VIMS 2014). Models also project that the region may see 1.5 to 6 feet of sea-level rise by the end of the century (Staudinger et al. 2015). A recent study conducted by VIMS for the state of Virginia projects a range of approximately 1.5 feet to over 7 feet of sea-level rise by 2100. The study recommends considering a foot and a half of sea-level rise over the next 20 to 50 years for planning purposes (VIMS 2013).

Climate Change and Species and Habitats

Understanding these potential climate impacts is important for designing short-term conservation strategies and actions to protect Virginia's fish and wildlife and the habitats where they live. Although some of these impacts may not occur in the next 10 to 25 years, it is very possible that extreme heat wave or storm events may occur earlier than average temperature or precipitation increases and have a more significant, immediate, effect on resources. These extreme events rather than averages will likely have the greatest impacts on species (Klopfer et al. 2012). Warmer winter temperatures could also affect vegetation phenology, which could have cascading impacts on wildlife species that depend on them (Staudinger et al. 2015). Another example involves cold water streams and dependent species. A cold water stream is defined in Virginia as a stream whose average annual water temperature does not rise above 70°F. If a heat wave in the summer increases water temperature over 74°F for a week or more, this temperature may appear to have a small impact on the stream's annual average water temperature, but it could cause the local extirpation of many species that are impaired by summer water temperatures warmer than 70°F (Klopfer et al. 2013).

DGIF worked with partners and CMI to develop a species climate vulnerability assessment (Kane et al. 2013). This project is described in detail in the Methods Section, but it provided significant climate data for Virginia and neighboring states as well as projections of climate impacts for a suite of SGCN from the original Action Plan. Based on this work and other research, some generalizations can be made about climate impacts on species in the state. For example, species that are at the southern end of their range in Virginia, such as red spruce may be lost as temperatures increase and habitats may become too

warm. Conversely, species at the northern end of their range, such as southern red oak or bald cypress, may be able to expand further within Virginia as habitats become more hospitable. As forest composition potentially changes, the range of wildlife species that depend on these habitats may also be altered. Temperature changes may also affect species that have narrow temperature tolerances such as cold water fish species, amphibians, and some reptiles and mammals (Kane et al. 2013).

Increased amounts of precipitation, especially in winter and spring, may result in flashier stream conditions, exacerbating water quality issues such as erosion and sedimentation, stormwater runoff issues, and nutrient pollution. Additionally, if precipitation increases occur earlier in the year and taper off in the summer when temperature increases, drought conditions would become more severe. This would affect water quality conditions, especially the concentration of nutrients and pollutants, directly affecting wildlife, fish, and invertebrate species. Sea-level rise will allow salt water to inundate areas further inland; affecting both freshwater and brackish wetlands. Increasing salinity levels would affect both plant and fish and wildlife species that have narrower salinity tolerances. More extreme storm events may result in significant and prolonged inundation may affect habitat availability for species such as shorebirds, waterfowl, and migratory birds that depend on coastal wetlands within Virginia for food, nesting, and wintering habitat.

It is important to consider, however, that these climate projections and potential impacts are generalizations, and the variability of actual climate impacts and species responses makes it difficult to provide detailed information about how individual species will respond to climatic changes. Species distribution will not just move to higher altitudes or upstream, but their movement will be based on a combination and interaction of factors. It is likely that climate change will result in species expanding or contracting their ranges in unexpected ways due to new and unique habitat conditions being created (Kane et al. 2013). Additional factors that will affect habitat and species distribution and movements include vegetation structure, landscape characteristics, topography, and soil characteristics. It is unlikely these features will change as rapidly as climate. How these variables interact will determine the success or failure of species in specific areas on the landscape (Kane et al. 2013). For example, while climate factors may increase the probability of occurrence for bobwhite quail in an area, the species' response is more likely to be influenced by habitat conditions on the ground. If landscapes are not managed to provide suitable nesting, brood-rearing, and escape cover, it is unlikely quail populations will be able to increase their populations or expand their distribution regardless of how favorable the climate becomes. Conversely, using proven habitat management strategies that can help address climate impacts, wildlife managers may be able to help species, such as quail or brook trout, withstand inhospitable conditions for a longer period of time (Kane et al. 2013).

Conservation Lands and Climate Assessment

Another way to consider climate impacts involves how climate change may affect “on the ground” conservation management, specifically in terms of conserved lands. The Conservation Lands and Climate Assessment (see Approach and Methods Section) considers how climate classes (envelopes) may change across Virginia and what that may mean for lands currently held in some form of conservation. The assessment identifies 9 climate classes (envelopes) based on combined temperature-precipitation for Virginia on both conserved and non-conserved lands. In comparing climate classes on conserved and non-conserved lands in the late 20th century to those projected for 2070, 2 climate classes present in the late 20th century are likely to be absent in the late 21st century (classes 34 and 54). The climate class with the largest loss (by area) on conserved lands is class 44 with a nearly 80 percent reduction in distribution by 2070 across the study area (Table 3.5) (Figures 3.7 and 3.8) (Klopfer and McGuckin 2015).

Table 3.5. Proportion of Climate Classes within Conserved and Non-Conserved Lands in Virginia (Klopper and McGuckin 2015).

Climate Class	Late 20th Century		Late 21st Century	
	% of Non CLN	% of CLN	% of Non CLN	% of CLN
34	2.7%	12.3%	0.0%	0.0%
35	4.8%	7.9%	1.2%	2.6%
36	1.7%	0.2%	2.2%	1.4%
37	0.1%	0.0%	0.9%	0.1%
44	39.4%	42.1%	8.5%	3.3%
45	25.4%	14.9%	34.2%	52.2%
46	0.2%	0.1%	7.6%	10.3%
47	0.0%	0.0%	0.3%	0.0%
54	17.9%	14.2%	0.0%	0.0%
55	7.8%	8.3%	34.0%	21.7%
56	0.0%	0.0%	11.2%	8.5%

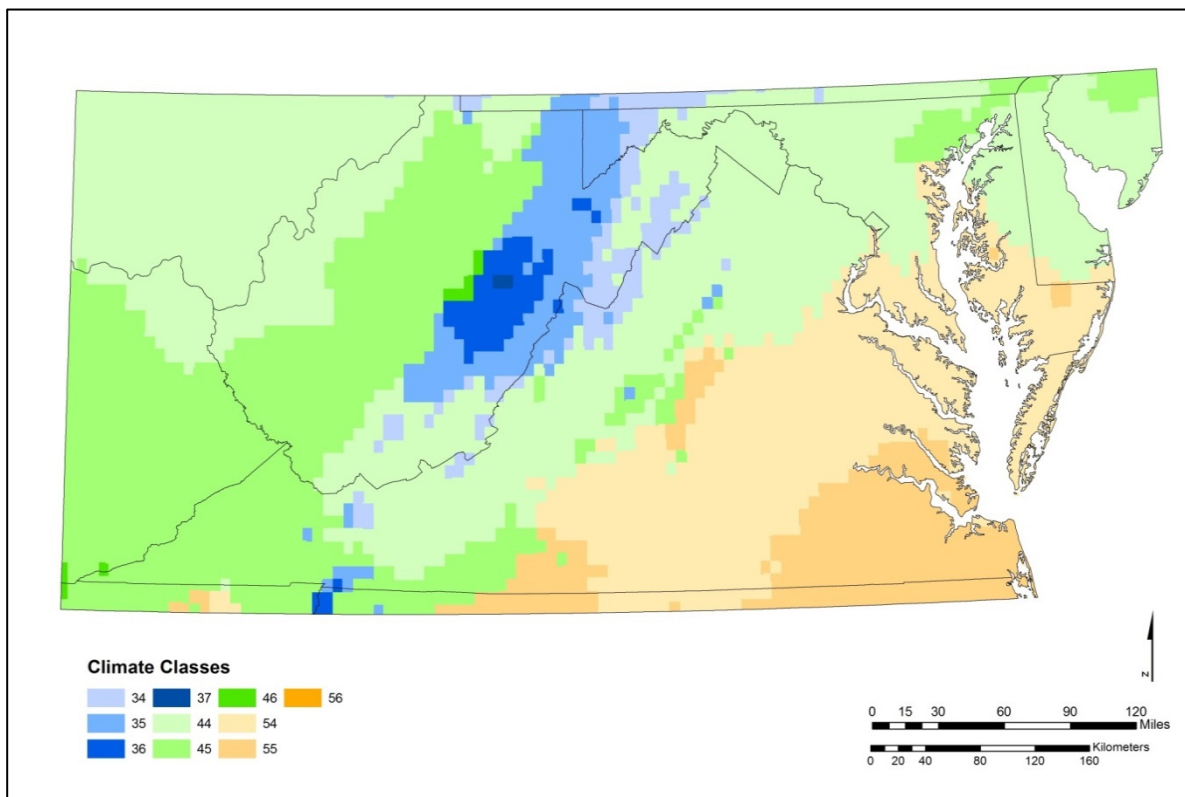


Figure 3.7. Climate Classes across Virginia in 2000 (Klopfer and McGuckin 2015).

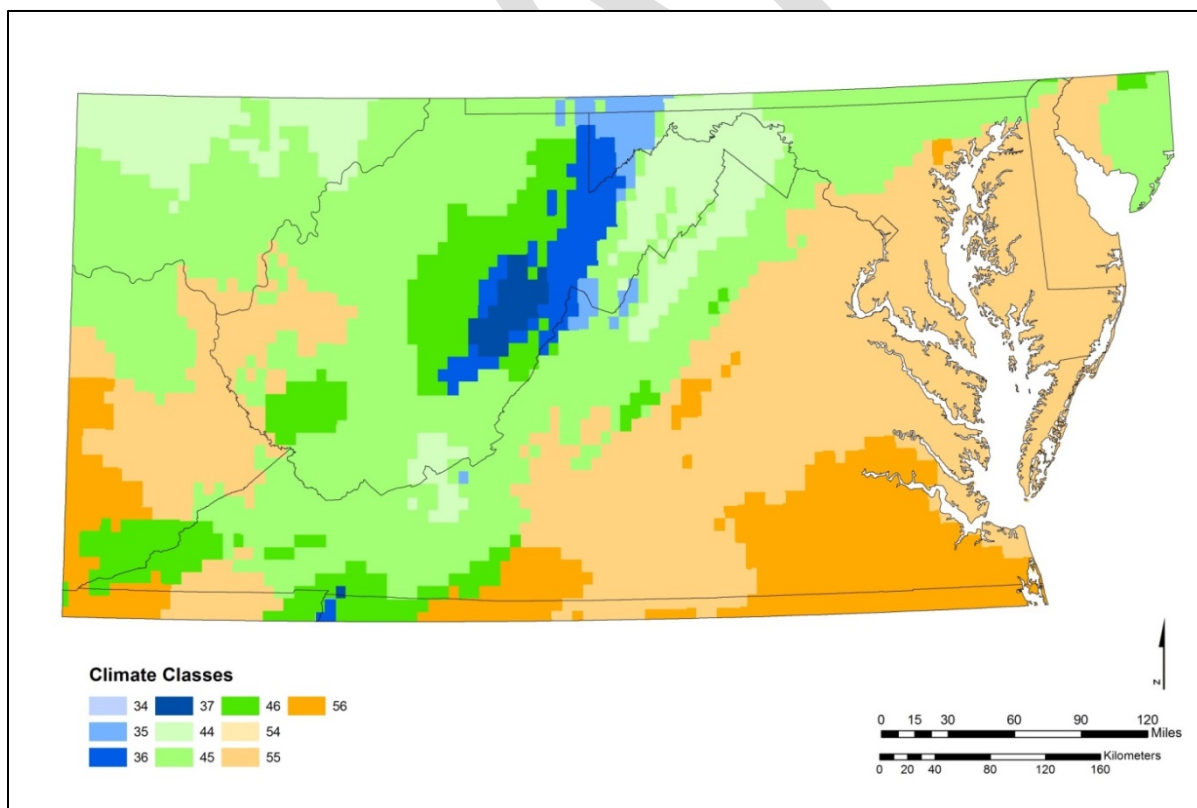


Figure 3.8. Climate Classes across Virginia in 2070 (Klopfer and McGuckin 2015).

The climate changes projected to occur across Virginia will result in shifting patterns from those evident in the late 20th century. While some climate classes will disappear completely, opportunities to bolster protection of other types with decreasing representation do exist. Further, some types with limited representation on current conservation lands will increase in composition into the future suggesting immediate actions to preserve those types may be unnecessary.

An example of a climate class that will disappear completely is climate class 34, which corresponds to the colder and drier areas of the higher elevations and latitudes in Virginia. While there is no direct evidence to support correlations between the climate classes used in this analysis and species distributions, it is interesting to note that this region has already been identified as containing species at the southern extent of their range (e.g., northern flying squirrels, snowshoe hare, etc.). Previous studies have suggested that these types of species are among the most vulnerable to climate change impacts due to the rarity of these habitat types and their relative isolation from other suitable habitat areas (Heller and Zavaleta 2009). The disappearance of this climate type from the landscape suggests that the resiliency of the landscape for supporting these species is low and that localized extirpation is a possibility.

On the other hand, dedicated habitat improvement actions may provide some level of mitigation of impacts and adaptation opportunities. For example, the range of the ruffed grouse extends southward along the Appalachians into the Carolinas even though the species core range is the Great Lakes and Northeast regions. Historically, this species was likely more widespread throughout the southeast, but their range has contracted to the highest elevations with increasing temperatures since the last glacial period. The persistence of this species on the landscape may have to do with an abundance of early successional forest regeneration following primary clearing after colonization and sustained through the early to mid-20th century.

Similarly, dedicated habitat management for target species may decrease the overall impacts of climate change for select species and locations. Further using models and analyses like these, managers may be able to identify areas to receive focus more intensive habitat management with sufficient lead time to allow for long-term activities to become effective. For example, understory tree manipulations performed today would affect the canopy characteristics 40 or more years from now and benefit target species. These actions could allow an improvement of overall habitat value and compensate for losses due to changing climate.

ON THE GROUND CONSERVATION ACTIONS

In reviewing the list of SGCN, DGIF staff and partners were asked to assign each species into one of three triage categories related to conservation and management opportunity (see Methods and Approach Section). Category A was reserved for instances when managers have identified “on the ground” strategies expected to benefit species and/or habitats. Category A also requires that at least some of these strategies be able to be implemented with existing resources and have a reasonable chance of improving a species’ conservation status.

Of the 884 SGCN identified for 2015, 207 (23.4%) are classified in Category A. For these species partners identified 31 basic management actions that could be implemented to improve their conservation status. The list of 31 actions follows. The number following each action represents the number of species to which that action applies. For specific actions identified for each of the 149 species, please see Appendix A.

1. Address water quality impairments (82)
2. Implement captive propagation/ translocation/ reintroduction (45)
3. Conserve/ restore wetland habitats (27)
4. Create/ restore/ manage – open habitats (glade, grassland, savanna) (21)
5. Engage in public education/ outreach (14)
6. Conserve/ restore of beaches, dunes, and mudflats (14)
7. Exclude/ manage human use of habitats at specific times (primarily beaches) (13)
8. Engage in predator control (12)
9. Control invasive plant and animal species (9)
10. Exclude humans from caves occupied by sensitive species (8)
11. Maintain the quality and quantity of water flowing into karst and other groundwater systems (8)
12. Continue environmental commenting and engagement with industrial citing for wind energy (6)
13. Manage diversity of young and old forest habitats (5)
14. Regulate legal harvest (4)
15. Restore aquatic connectivity (4)
16. Protect known fall roosts and swarm areas for bats (4)
17. Conserve/ restore large forest blocks (3)
18. Work with industry to modify operation of wind farms during fall migration period (2)
19. Develop professional standards for wildlife control operators (2)
20. Research use of artificial nest boxes (2)
21. Enforce collection laws (2)
22. Protect (aquatic) spring habitats (2)
23. Conserve/ restore occupied canebrake rattlesnake habitat (1)
24. Conserve/ restore coastal eel grass beds (1)
25. Conserve/ restore migratory habitats for birds in coastal areas (1)
26. Create artificial wetlands (1)
27. Modify and enforce baitfish regulations (1)
28. Reduce/ eliminate heavy metal and pesticide contamination (1)
29. Maintain/ create artificial roost structures (1)
30. Restore the freshwater drum – fish host of the fragile papershell (1)
31. Conserve/ protect specific habitats occupied by the Virginia fringed mountain snail (1)

PRIORITY RESEARCH NEEDS

Conservation Opportunity Ranking Category B was reserved for those species that met one of two conditions. Either managers have identified specific research needs that must be addressed before more “on the ground” actions can be initiated or the conservation community has been precluded from implementing “on the ground” actions due to a lack of personnel, funding, or other circumstances. Of the 884 SGCN, 63 (7.1%) are assigned to Category B. The list of research needs for these species follows (no priority order). In future budget discussions, it is DGIF’s intention to use this list to prioritize the research projects funded through State Wildlife Grants.

- Improve detection methods for hellbenders to better estimate population size and distribution – both to document initial conditions as well as to help evaluate effectiveness of conservation actions.

- Investigate the utility and opportunity of using translocation as a management and recovery tool for hellbenders.
- Assess the impacts of wind farms on migratory birds in the coastal region to enhance species management, habitat management, and environmental commenting.
- Determine American woodcock wintering and breeding abundance to facilitate creation of a management strategy.
- Determine how or if a growing peregrine falcon population on the Eastern Shore impacts red knot populations.
- Research belted kingfisher, black-billed cuckoo, chimney swift, eastern wood peewee, green heron, and northern flicker to determine the circumstances that threaten these species and the impacts of these threats to populations so that appropriate management strategies can be developed.
- Develop conservation plans for a the following species:
 - Variegate darter,
 - Tennessee darter,
 - Atlantic sturgeon, and
 - Marine mammals, including Atlantic bottlenose dolphin, harbor porpoise, fin whale, humpback whale, northern right whale, West Indian manatee.
- Determine if the following species would be suitable candidates for reintroduction into suitable, vacant habitats:
 - Duskytail darter,
 - Ashy darter,
 - Candy darter,
 - Greenfin darter,
 - Longear sunfish,
 - Orangefin madtom,
 - River redhorse,
 - Sauger,
 - Smallmouth redhorse, and
 - Spotfin chub.
- Investigate the issue of “genetic swamping” to determine if contact with rock bass populations is a critical threat to the genetic distinctiveness of the Roanoke bass.
- Determine if conservation of the roughhead shiner is limited by competitive interactions with the telescope shiner or other members of the genus *Notropis*.
- Determine if or how changing climatic conditions are affecting the Allegheny pearl dace.
- Determine if or how changing climatic conditions are affecting the Swannanoa darter.
- Locate maternity colonies of the eastern big eared bat populations.
- Determine effects of wind turbines on eastern big eared bat and Indiana bat populations.
- Determine the extent and effects of insecticide contamination and bioaccumulation on eastern big eared bat and Indiana bat populations.
- Assess coastal migration patterns for hoary bats, silver-haired bats, red bats, and Virginia big eared bats.
- Determine why various bat species appear to be attracted to wind turbines and work to develop deterrents.
- Evaluate the productivity and survivorship of little brown bats, northern long-eared bats, tricolored bats, southeastern myotis, and eastern small footed myotis at maternity colonies as a means of evaluating the success of conservation actions.

- Identify foraging habitat preferences for Virginia big eared bats.
- Determine if the following freshwater mussel species are suitable candidates for captive propagation and, if so, develop propagation techniques:
 - Appalachian monkey face,
 - Crackling pearly mussel,
 - Deer toe,
 - Cumberland monkey face,
 - Fine rayed pig toe,
 - Tennessee club shell,
 - Rough rabbits foot,
 - Shiny pigtoe,
 - Elephant ear,
 - Tennessee heel splitter,
 - Tennessee pig toe,
 - Slabside pearly mussel,
 - Northern Lance mussel,
 - Pimpleback,
 - Pistol grip,
 - Spectacle case,
 - Three ridge, and
 - Pink heelsplitter.
- Resolve taxonomic confusion between the purple bean and the Cumberland bean so appropriate brood stocks can be identified to support captive propagation efforts.
- Determine the genetic distinctiveness of alewife floater populations in the Rappahannock, Pamunkey, James, Chickahominy, and Chowan basins so propagation and reintroduction strategies can be developed.
- Determine if the Virginia pigtoe is a distinct species or a population of the Atlantic pig toe.
- Determine if sufficient numbers of slippershell mussels exist to serve as brood stock for a captive propagation program.
- Determine if the two known populations of Bunting's crayfish in Virginia (one in the Big Sandy Basin and the other in the Clinch River) represent one species or two so appropriate management and conservation strategies can be developed.

SGCN DISTRIBUTION, ABUNDANCE, AND LIFE HISTORY INFORMATION

The vast majority (69.5%) of Virginia's 884 SGCN species were included in Management Opportunity Category C. Species were included in this category for one of two reasons. In many cases, such as the Shenandoah salamander, conservation opportunities have been exhausted. While this species may remain imperiled, no additional actions can be taken on their behalf as the only known population in Virginia is contained within a National Park system.

Category C was also used when managers were unable to identify "on the ground" actions or research needs that could benefit the species or its habitats. The vast majority of these species lack the basic distribution, abundance, and life history information needed to formulate a management strategy or applied research program. This is an overwhelming issue, affecting many SGCN. However, given current

personnel and financial resource limitations, it is a logistical impossibility that DGIF and partners will ever be able to fully address this data need.

It is DGIF's intention to continue to commit some portion of State Wildlife Grant dollars to collect baseline data on Category C species. However, this list of species will be reviewed and prioritized to ensure that resources are used efficiently and efforts provide the greatest management utility in terms of keeping species from becoming endangered.

Before Virginia's next Action Plan is written (2025), DGIF will institute a prioritization process, involving DGIF biologists and administrators, as well as representatives from other state, federal, and private organizations that will identify priority species and areas for collecting baseline species and habitat data.

PROPAGATION AND RESTORATION OF SGCN

Virginia's aquatic habitats support some of North America's most diverse assemblages of aquatic mollusks, fish, and crayfish. Historic and continuing loss of habitat and habitat fragmentation, water pollution, sedimentation, invasive species introductions, hydrologic modification and impoundments have reduced many of these populations to critical levels and severely restricted many species' distribution.

Virginia has a long history of propagating game fishes in hatcheries to augment existing populations and establish new populations in unoccupied habitats. In 1997, Virginia Tech's Freshwater Mussel Conservation Center began propagating and releasing endangered mussels to augment wild populations. In 1998, DGIF established the Aquatic Wildlife Conservation Center (AWCC) near Marion, Virginia to restore populations of imperiled mussels in the Upper Tennessee River drainage. The AWCC has also propagated the endangered spiny river snail (*Io fluviatilis*) and eastern hellbenders (*Cryptobranchus alleganiensis*). In 2007, the DGIF and USFWS established the Virginia Fisheries and Aquatic Wildlife Center (VFAWC) at the Harrison Lake National Fish Hatchery in Charles City County to propagate mussels for release into Virginia's Atlantic slope rivers. Since 2010, DGIF has contracted with Conservation Fisheries Inc. to propagate and release federally endangered yellowfin madtom (*Noturus flavipinnis*) into the upper reaches of Copper Creek, a tributary of the Clinch River. Efforts are also underway to propagate and release yellowfin madtoms into the North Fork Holston River.

It is DGIF's intention to continue supporting these propagation and restoration activities with State Wildlife Grants and other resources. While current SGCN efforts largely focus on aquatic species, species in other taxonomic groups may also be considered as appropriate. The target species, the use of State Wildlife Grants, and the priority of individual efforts will be determined during DGIF's project planning, annual budget development, and annual work planning efforts.

DATA MANAGEMENT FOR MIGRATORY SPECIES

Virginia's 2015 Action Plan identifies dozens of migratory birds, fish, and insects that, throughout the course of their life, cross regional, national, and international borders. State fish and wildlife agencies collect and compile a wide variety of biological and ecological data which, when assembled with similar data collected by other states, regions or countries can greatly enhance our ability to evaluate trends in

species population sizes and distribution, habitat losses and gains and other common parameters across broad geographic areas. Unfortunately, these disparate data are rarely compiled or managed to provide biologists with “the big picture” that would better inform local conservation efforts. As more migratory species are included within Action Plans, there is a growing need among managers to coordinate survey and monitoring efforts, using standardized data collection methods and protocols. To be most effective, this data should be compiled and managed in a centralized database that is accessible to all users. Such a system has been developed to support waterfowl conservation and management. Lessons learned by the waterfowl community can inform and enhance efforts for other taxonomic groups.

Unfortunately, the USFWS lacks the human, financial, and technical resources needed to develop, house, and manage such a large and long-term data effort. In response, state wildlife agencies are exploring opportunities to:

- Develop a partnership agreement, guiding data ownership, use, and management access;
- Establish a storage location for the assembled data that can be accessed by the partners;
- Establish a database or data warehouse (i.e., a set of databases) with a mapping component that can display the data; and
- Partition development costs and annual costs of long-term database QC/QA and general maintenance responsibilities among data-contributing states.

Developing such a system would enhance Virginia’s ability to contribute to the conservation of species that cross multiple jurisdictions. The use of State Wildlife Grants to support this effort will be considered as part of DGIF’s annual budgeting process.

INTERNATIONAL CONSERVATION

Dozens of migratory SGCN songbirds, waterfowl, shorebirds, and the monarch butterfly utilize habitats in Virginia as part of their annual migratory cycle. Due to threats impacting these species in other states or countries, conservation efforts in Virginia may be insufficient to ensure the long-term conservation of many of these species.

DGIF currently participates in several multi-stakeholder programs (Joint Ventures, Fly-Way Council, Partners in Flight, Southern Wings Program) that work to monitor and conserve these migratory species. As part of these collaborative efforts, DGIF may consider using a portion of its State Wildlife Grant allocation to conserve habitats or conduct research in other jurisdictions if those efforts have the potential to improve the status of one or more of Virginia’s SGCN. DGIF’s participation with such a project would be considered as part of DGIF’s annual budgeting process and contingent upon an internal review by appropriate agency staff.

NORTHEAST WILDLIFE DIVERSITY TECHNICAL COMMITTEE AND THE REGIONAL CONSERVATION NEEDS PROGRAM

The Northeast Association of Fish and Wildlife Agencies, traditionally, has supported a strong technical committee structure to further wildlife conservation. Technical committees are species or habitat-focused groups that exchange ideas and develop common approaches to wildlife issues. Typically, these

conservation actions are implemented by individual states using their own funds; however, in some cases additional funding has been made available through the Northeast Wildlife Agency Directors. In one such case, the Directors established the Regional Conservation Needs (RCN) Program which is managed by the Northeast Wildlife Diversity Technical Committee.

The RCN Program utilizes a small percentage of each state's annual State Wildlife Grant allocation to address SGCN needs across multiple states. Specifically, the RCN Program is used to coordinate and implement conservation actions that are regional/ sub-regional in scope and build upon the many regional initiatives that already exist. Since 2007, thirty-seven different projects have been implemented. The resulting reports and products can be found at RCNgrants.org. Output measures related to the RCN Program include monitoring the number of conservation actions and research projects selected by the participating agencies, the number of projects completed by the funding recipients, and the number of articles, publications, and technical reports developed each year as a result of funded projects.

It is DGIF's intent to continue contributing SWG funds and personnel resources to support the RCN program and the Northeast Wildlife Diversity Technical Committee.

CONCLUSION

From a statewide level, reviewing conservation needs in this Action Plan may be discouraging as hundreds of species are identified as being of greatest conservation need. Many species populations are already critically impaired, and their long-term survival is in doubt. Management concerns over the loss or degradation of Virginia's aquatic, wetland, terrestrial, subterranean, and coastal habitats, which will likely be compounded by the potential impacts of climate change, land subsidence, invasive species, and sea level rise, are not inconsequential. If we fail to address these issues, more species could be legally classified as endangered, which could have profound impacts for people, businesses, and communities, as well as wildlife.

Alternatively, the statewide chapter can be viewed from the perspective of implementation. The chapter focuses on what the conservation community can do to best protect and conserve species and habitats within the Commonwealth. Management actions have already been identified for scores of these species and habitats that, if implemented, are likely to benefit hundreds of additional SGCN. Important research needs have been identified that should allow conservation partners to implement more "on the ground" conservation for dozens of species. Many of the threats affecting Virginia's terrestrial and aquatic habitats can be addressed with known techniques and technologies. In several cases, habitat programs already exist. Finally, and perhaps most importantly, Virginia has a robust and dedicated conservation community, comprised of agency and NGO staff, academics, and talented enthusiasts, who have proven that great things can be accomplished when efforts are focused and burdens are shared.

Sir Patrick Geddes (1854 – 1932) was a Scottish sociologist, geographer, and town planner who is credited with championing the notion that biogeography, geomorphology, and human systems are interrelated and that the healthiest communities recognize the importance of, and manage to maintain, the health of these relationships. Geddes work has often been credited as the inspiration for the slogan "Think Globally, Act Locally" used by grassroots activists worldwide. In this tradition, it is DGIF's intent that the revised Action Plan will define problems based on areas of common interest. This updated version was created to find ways to keep species from becoming endangered. While this perspective

may seem limited, the majority of conservation issues we face are not just “wildlife issues” but are, in fact, Virginia issues for which wildlife are an indicator. Clean and healthy rivers are important for wildlife, people, communities, and industries. Healthy riparian forests, wetlands, and upland habitats provide people with economic and recreational opportunities, while also supporting diverse wildlife species and helping to ensure clean water flowing thru our landscapes. As waters flow from Virginia towards the Atlantic Ocean or the Gulf of Mexico, these rivers, and their adjacent habitats, support even more species, communities, industries and recreational opportunities. Working to keep species from becoming endangered benefits our communities, our economy, and our quality of life by addressing the problems that exist within our collective habitats and preventing them from becoming a crisis.

Based on the idea that local actions can generate regional shared benefits, and using a format perfected by the Virginia Department of Conservation and Recreation, this Action Plan was created around 21 Local Action Plan Summaries. Each of these local chapters describes the wildlife and habitat priorities identified by DGIF and partners within each multi-county planning region. These local chapters are not mandates. Rather, they identify shared problems and describe the types of actions that can be taken to address conservation priorities. Ideally, these summaries will inspire collaboration among the conservation community and provide guidance as to how limited time, money, and people can be utilized to best effect. Groups with other focuses such as clean water, open space, outdoor recreation, commercial fisheries, or civic enhancement may use these documents as a means of forging new collaborations that achieve mutual goals. By defining collective problems, the Local Action Plan Summaries may provide opportunities to find or develop new conservation funding and resources.

The problems outlined within this revised Wildlife Action Plan can be addressed. It will require time, resources, and dedication, and a little luck. It is within our ability to prevent many of these species from becoming endangered while also doing beneficial things for human communities. Like any thousand-mile journey, this one will start with the first step.

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5. ACCOMACK-NORTHAMPTON PLANNING REGION LOCAL ACTION PLAN SUMMARY

6. CENTRAL SHENANDOAH PLANNING REGION LOCAL ACTION PLAN SUMMARY

7. COMMONWEALTH PLANNING REGION LOCAL ACTION PLAN SUMMARY

8. CRATER PLANNING REGION LOCAL ACTION PLAN SUMMARY

9. CUMBERLAND PLATEAU PLANNING REGION LOCAL ACTION PLAN SUMMARY

10. GEORGE WASHINGTON PLANNING REGION LOCAL ACTION PLAN SUMMARY

11. HAMPTON ROADS PLANNING REGION LOCAL ACTION PLAN SUMMARY

12. LENOWISCO PLANNING REGION LOCAL ACTION PLAN SUMMARY

13. MIDDLE PENINSULA PLANNING REGION LOCAL ACTION PLAN SUMMARY

14. MOUNT ROGERS PLANNING REGION LOCAL ACTION PLAN SUMMARY

15. NEW RIVER VALLEY PLANNING REGION LOCAL ACTION PLAN SUMMARY

16. NORTHERN NECK PLANNING REGION LOCAL ACTION PLAN SUMMARY

17. NORTHERN VIRGINIA PLANNING REGION LOCAL ACTION PLAN SUMMARY

18. NORTHERN SHENANDOAH VALLEY PLANNING REGION LOCAL ACTION PLAN SUMMARY

19. RAPPAHANNOCK-RAPIDAN PLANNING REGION LOCAL ACTION PLAN SUMMARY

20. RICHMOND REGIONAL PLANNING REGION LOCAL ACTION PLAN SUMMARY

21. REGION 2000 PLANNING REGION LOCAL ACTION PLAN SUMMARY

22. ROANOKE VALLEY-ALLEGHANY PLANNING REGION LOCAL ACTION PLAN SUMMARY

23. SOUTHSIDE PLANNING REGION LOCAL ACTION PLAN SUMMARY

24. THOMAS JEFFERSON PLANNING REGION LOCAL ACTION PLAN SUMMARY

25. WEST PIEDMONT PLANNING REGION LOCAL ACTION PLAN SUMMARY

26. APPENDIX A. SPECIES OF GREATEST CONSERVATION NEED